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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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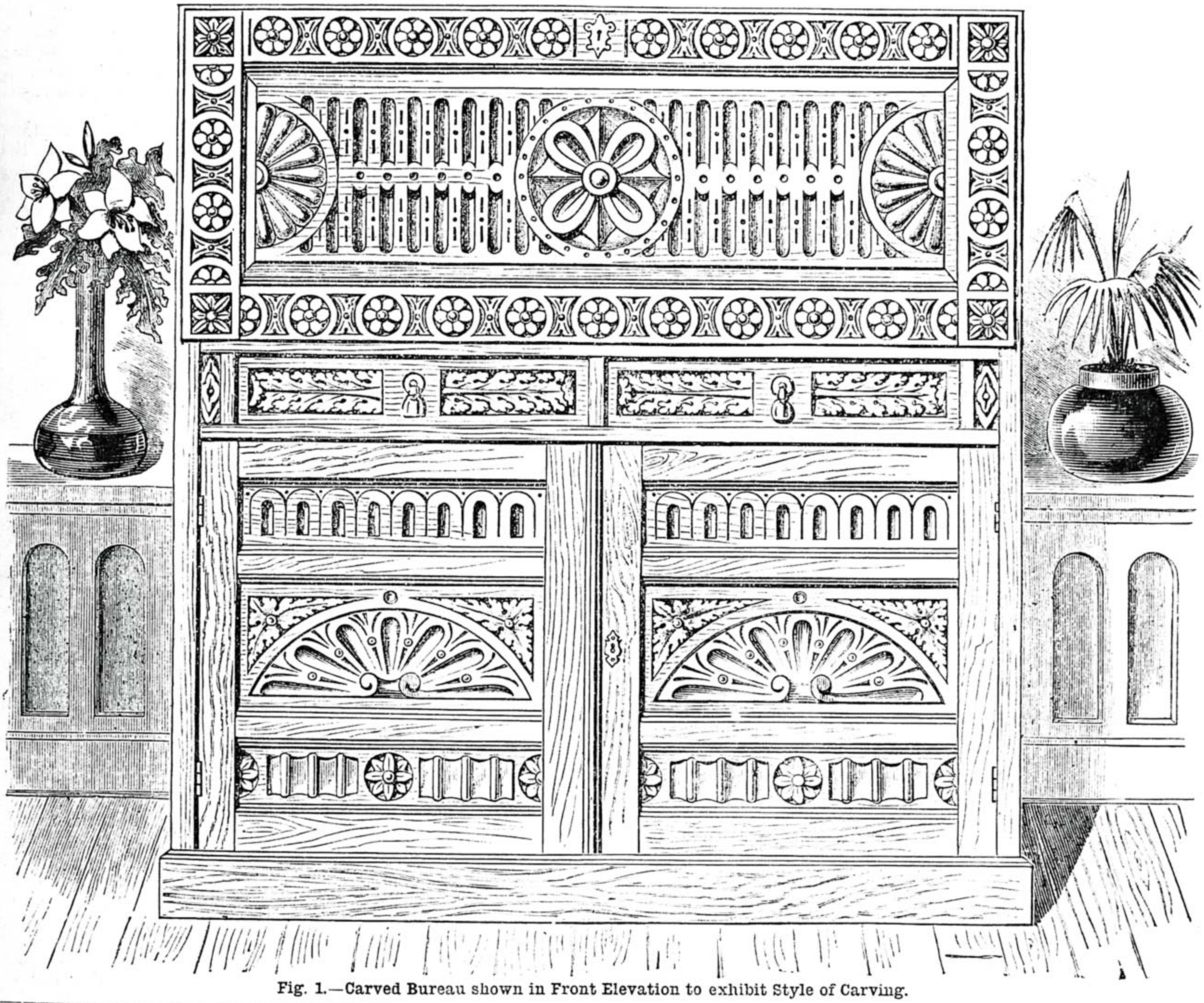

Fig. 1.—Carved Bureau shown in Front Elevation to exhibit Style of Carving.

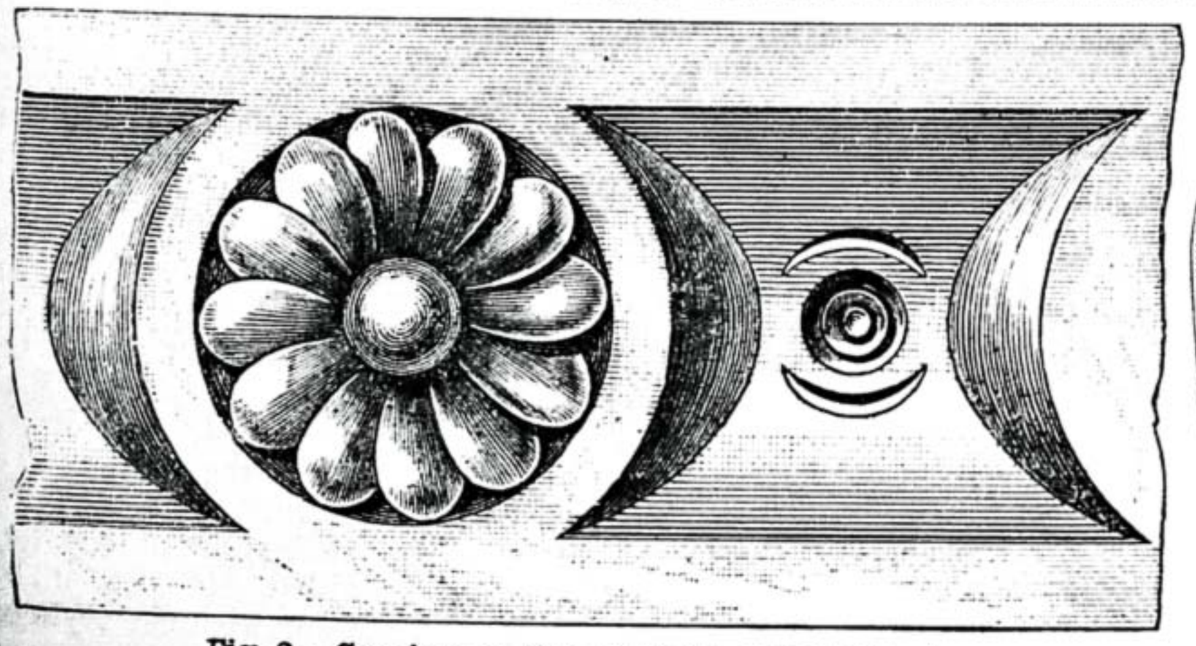

Fig. 2.—Carving on Frame of Lid, enlarged.

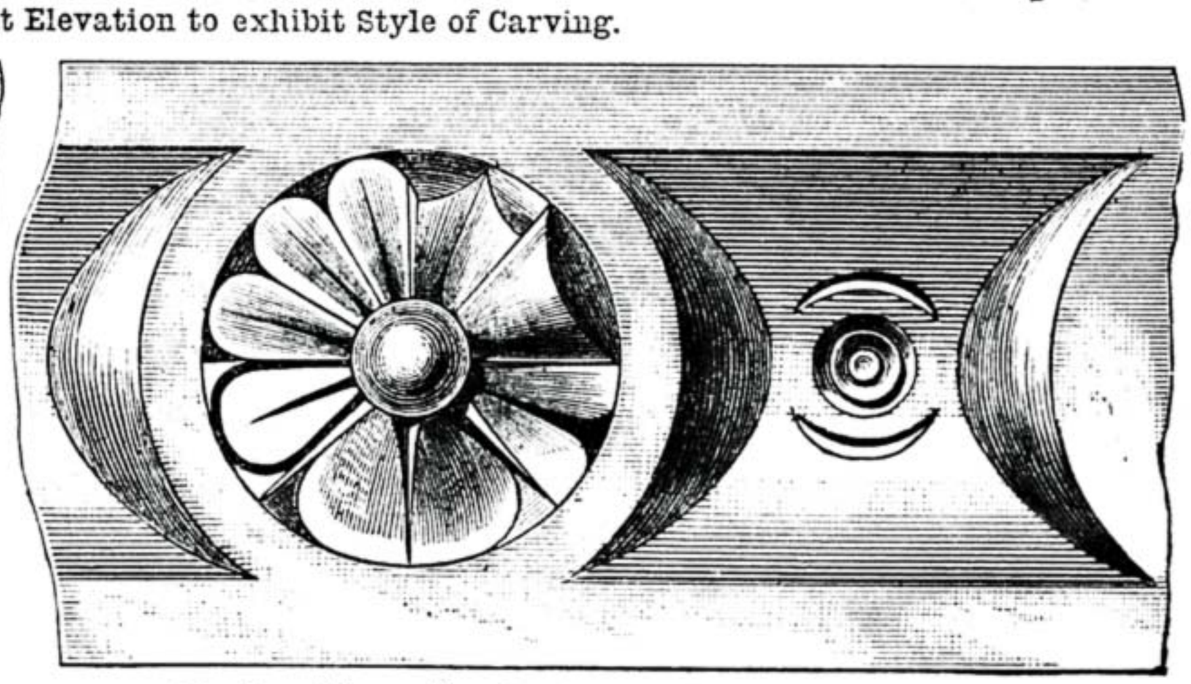

Fig. 3.—Alternative Designs for Pateras in Frame.

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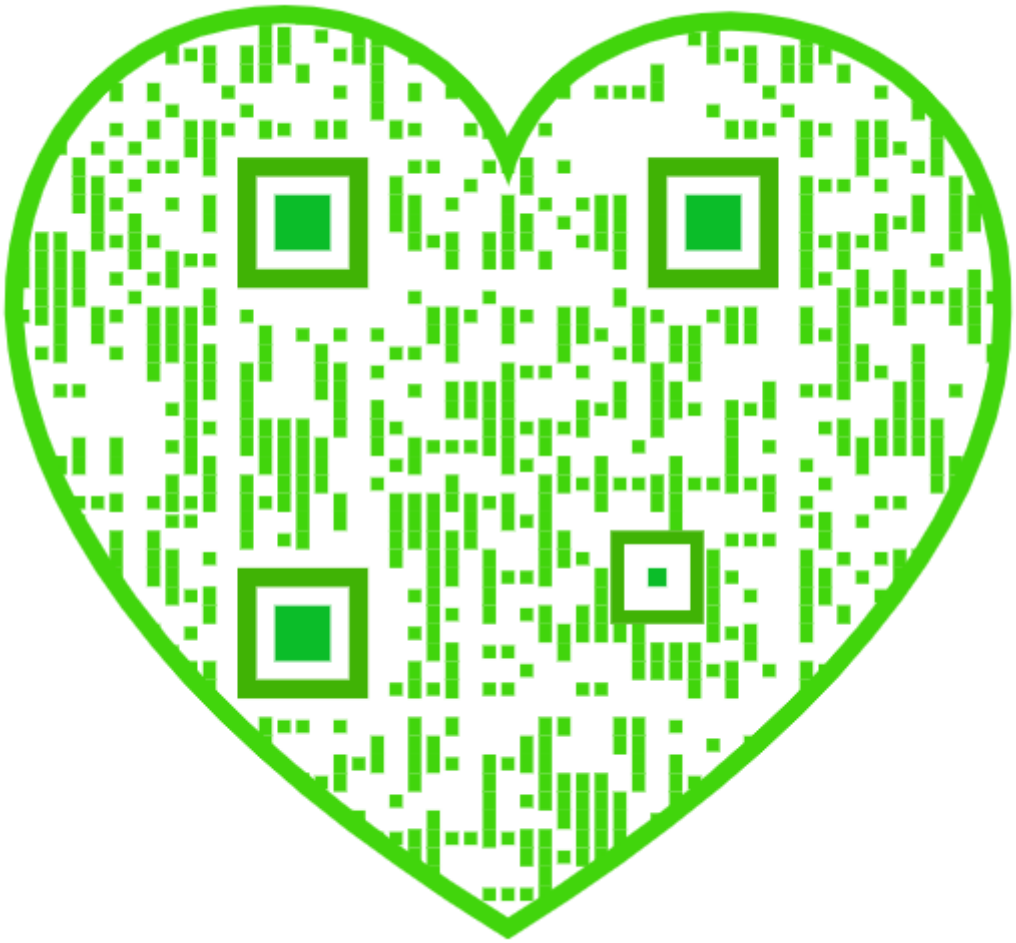

A CARVED BUREAU.

BY D. ADAMSON.

We have in previous papers considered the old bureau and a bureau in "Gothic" style. The next style of bureau which demands our attention is one which prevailed more or less during the latter part of the sixteenth and the greater part of the succeeding century. It must not, however, be supposed that art as applied to woodwork was at a standstill, and that no variety in style is discernible during this period; for there are differences in ornamental detail by which the Elizabethan or late Tudor style is distinguishable from the succeeding Jacobean. These comparatively trifling differences, however, need not be dilated on, for the prevailing characteristic of domestic woodwork decoration throughout them is much the same. If we examine any of the numerous specimens which have survived, we find the predominant feature to be bold, effective carving with little, if any, attempt at rendering natural forms. The designs are strictly conventional where foliage is represented, and simple geometrical forms are largely used. We thus see that the motives

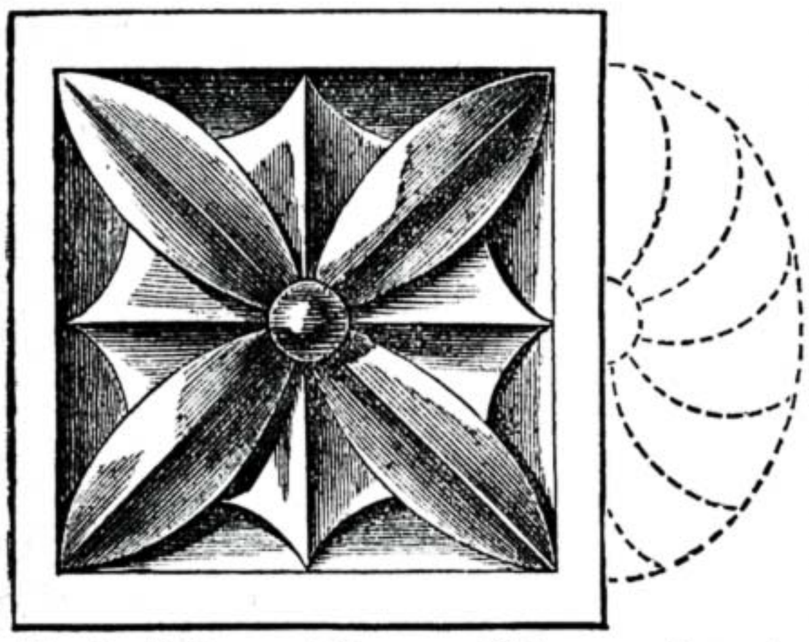

Fig. 4.—Pattern at Corners of Frame, enlarged.

which inspired the designers are in accordance with correct principles. There is no endeavour merely to imitate natural objects, and one has only to look at a piece of work of the period referred to to recognise the good general effect which was produced by the simplest means. Much of the work was crude in execution, but there was a boldness in its conception, an absence of all finnicking over-elaboration, which renders it so attractive not merely to students of woodwork but to the most casual observer. Please do not, however, suppose that this is intended to mean that it should be merely copied nowadays. Far from that, as the only result would be deterioration of the worker's powers. If we want to make a facsimile of some old work well and good, then copy from it; but if the intention is to make a given piece of furniture in a given style, all we have to do—so far as the design is concerned—is to seize some of its leading features, or, to use an expressive term, the feeling of the style, and embody the details in any article, whether of cabinet making or otherwise, which may best fulfil its intended purpose. It must be understood that the accompanying illustrations by no means exhaust the varieties of ornament which are to be found in Elizabethan woodwork. To do so would be impossible within a moderate space, and all that can be managed within the limit of these papers is little more than an indication of what may be done in the way of ornamenting woodwork by carving in what may be described as the English version of the Renaissance. We find a similar style prevalent throughout Europe, not identical in detail, each country giving a rendering of its own,

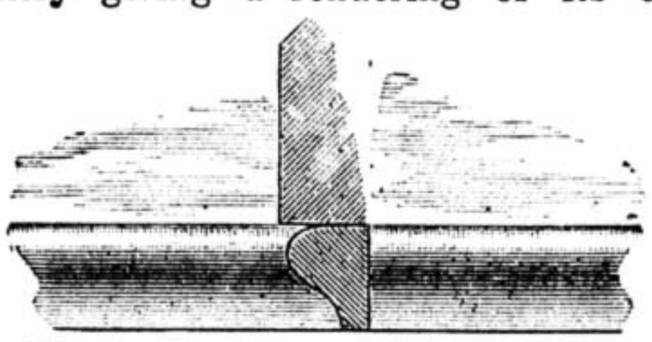

Fig. 5.—Moulding exhibiting Section.

but all emanating and expanding from the Renaissance originated in Italy.

So much for theory; now let us see how it is to be applied to the bureau. To begin with, for the encouragement of those who are not skilful carvers, it may be said that carving tools as now understood are not absolutely necessary. In the designs to be given there is nothing that may not be managed with ordinary carpenters' chisels and gouges. If carvers' tools are available, well and good, the work may more easily be performed, but certainly none of the more modern forms—the bent tools and others which carvers use nowadays—will be required. There is no undercutting, while all the work is bold and free. Those carvers—or should they not be described as carpenters, who used their chisels as freely for decoration as for construction?—of the days of good Queen Bess understood how to produce effect by the simplest means. Take the front of an old chest or cabinet, with its wealth of cutting as the old craftsman would probably have called it, how elaborate it seems, with perhaps scarcely an inch of its surface undecorated by carving, yet analysed it will be seen that there is in truth little that could not be attempted by the veriest tyro. Bold effective lines without much depth, which it requires only a slight acquaintance with the art of carving to discern, may be cut and shaped with the most rudimentary tools. But let not the beginner fall into the mistake of supposing that the breadth and general good effect can be produced by purposely leaving the work in a rough state. He is apt to do so, but let him instead give the highest finish he can to his work, taking care at the same time not to destroy the vigour and robustness which characterised the mediæval craftsman. Let the work be bold, but not necessarily rough. The former quality stamps its character with merit; the latter depreciates it. A bad, or, not to put it so strongly, an inferior design executed with vigour is preferable to one of superior merits weakly carried out. To combine robustness of work with proper finish is not so easy as it might at first appear, and as those who have attempted it well know. Still, this should be the aim of any wishing to excel in good carved work such as is under consideration. The illustration of the bureau shows a considerable quantity of carving, but it may be as well to state that there is no necessity for carrying out the design in its entirety. It will be noticed that a departure from the original construction is shown, two doors having taken the place of the three long drawers. This alteration is partly made as a suggestion that a cupboard may take the place of these, and partly because the carving of three drawers, or rather their fronts, might become monotonous.

This leads me to say that those who prefer to have the drawers may, if they do not wish to dispense with them, fit them inside the doors. Further, if they do not care for doors, it is not necessary that each drawer front should be of exactly the same pattern. The details of each rosette or patera, for example, may be varied, but this suggestion will be more of service to those who are fairly acquainted with the principles of design than to beginners, in whose hands there is a danger of the result being too patchy to be pleasing.

Well, now let us refer to the illustration, Fig. 1, which gives a general idea of the carved bureau, much of the detail being necessarily left out, or at most merely indicated. By the way, the front only is drawn in elevation, but there will be no difficulty in recognising the various parts. Let us take the lid first. This may be either made with the panel flush as in the original bureau, or sunk assuggested, when dealing with the Gothic design. As the panel is rather a large surface to carve, it may have a bevelled edge with advantage to those who do not wish to bestow too much labour on it. Of course, the bevelling, which may be an inch or so wide, considerably reduces the surface to be carved, so that the effect of a panel covered with carved ornamentation may be produced without so much actual work. The framing around the panel may be either left plain or be carved as shown. To convey as far as possible the pattern, which, of course, must be drawn of a suitable size on the wood itself, illustrations on an enlarged scale are given, which, it is hoped, will make the ideas sufficiently clear to enable those who are not conversant with actual carvings of the kind represented to reproduce them. Fig. 4 shows the pattern at the four corners of the frame, and Fig. 2 the remainder. In case the cutting of so many pateras exactly the same may be monotonous, suggestions for varying them, while keeping them in harmony with each other and the rest of the work, are given in Fig. 3. The frame may also be left uncarved, like the door frames, if preferred, and, it is almost needless to add, these may be carved in a similar manner. It will be noticed that the long rails, those at the top and bottom, are moulded on the inner edges. To be in character with the style of

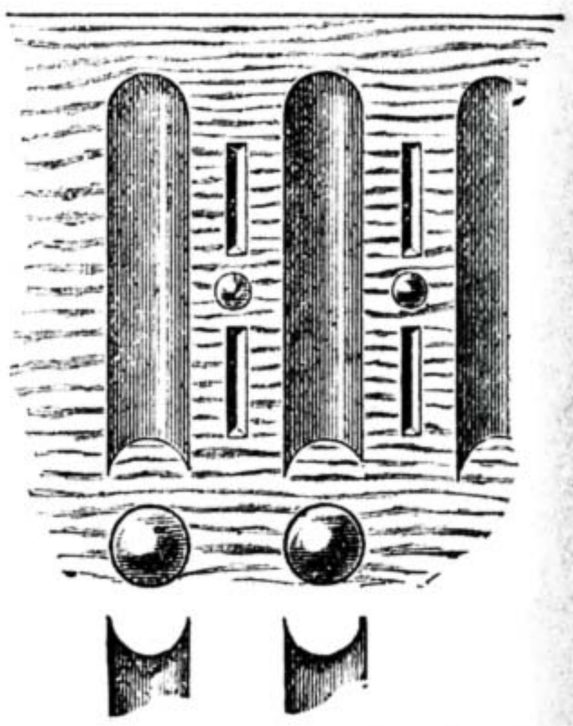

Fig. 6.—Carving on Panel.

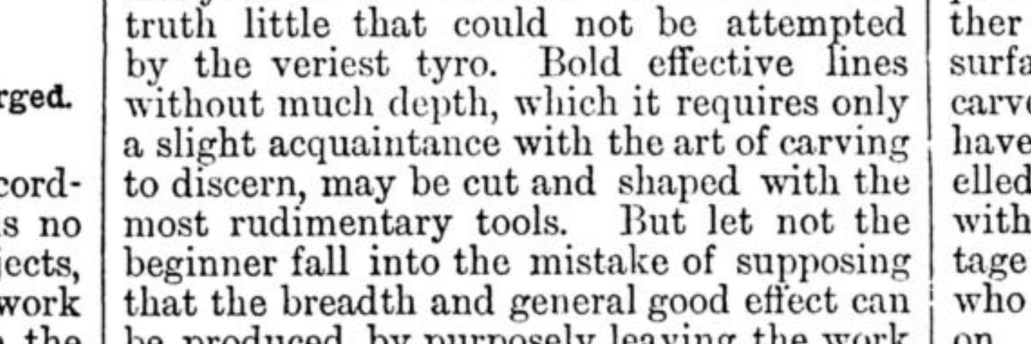

Fig. 7.—Carving on Drawers.

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decoration, these mouldings should, strictly speaking, be worked on the solid, *i.e.*, instead of gluing them to the framing, they should be cut on the framing. This, however, may be rather more trouble than the amateur artisan would be disposed to take, and with care a very serviceable job may be made with mouldings stuck on. A suitable moulding is shown in section in Fig. 5, which also gives a portion of the flat frame. The carving on the panel itself is represented by Fig. 6, while that on the drawer fronts is shown by Fig. 7. The door panels are carried out much as the other carving, and no minute description can, therefore, be necessary. Each door, it will be seen, has three panels; the middle one being the principal, with fluted carving arranged in circular form, instead of being straight as on the lid. As the flutes converge towards a centre, they, of necessity, assume a tapering form. The top and bottom panels are simply flutes similar to those on the lid, but shown of a simpler form, with the addition of pateras on the bottom panel. The door framing should be fastened with the ordinary mortised and tenoned joints, the two intermediate rails being tenoned into the stiles. If the lower part is to have drawers behind the doors, it will be better to hinge these on, instead of within the ends,* as shown in Fig. 1. To do so, of course, the end pieces must be cut away to the thickness of the door framing, and the doors themselves be correspondingly wider. By hingeing the doors on the ends, it will be seen that the drawers can be the full length of the inside of the cupboard part; but if they are hinged within, the ends must be lined up, or thickened, that the drawers may work clear of the doors.

Much more might be written about the bureau in this old English style, which, undoubtedly, is a most interesting one, but space forbids. I may, however, say that many, if not most, of the old chests which one meets with, not to mention other articles of carved oak furniture, principally chairs and tables, are often rich in suggestions to the designer.

With this let us pass on, merely observing that the style known as "Queen Anne" was evolved from the one just considered, with which, for all practical purposes, it may be said to be almost identical, except that it indicates a closer adherence to classic forms, and, consequently, greater simplicity prevails in it. In the furniture of the Queen Anne period there is also much that shows Dutch ideas to have been largely borrowed; but as at present rendered in modern furniture, the term "Queen Anne style" is remarkably comprehensive, and, at its best, is founded on architectural details of the period which gives its name to it. For various reasons a "Queen Anne" bureau need not be given now, but it may be said that the style prevailed during the reigns of William of Orange, whence much of its Dutch character, and Queen Anne, to whom its name has been given, till well on into the eighteenth century, when domestic furniture, as we now understand it, assumed an importance it had not hitherto occupied. At the commencement of the second half of the eighteenth century the style known as Chippendale was all the fashion, and it may be interesting to note that, for the first time in the history of English furniture, this is distinguished by a name of its own apart from architectural nomenclature.

* See article on Hinges, etc., in No. 7.

PLAIN AND DECORATIVE HOUSE PAINTING.

BY A LONDON DECORATOR.

MIXING OIL PAINTS AND COMPOUNDING TINTS AND SHADES OF COLOURS FOR PRACTICAL USE (*continued*)—FOURTH COAT.

THE cornice is now ready for flatting, and the walls for the fourth and last coat of oil paint. I break up lead and paste driers with former proportions of solids, but all turpentine, into batter consistency. I then divide it into the amount required for the three divisions of cornice, stain them a few degrees lighter than the respective oil-ground colours, using the blue, red, ochre, and umber pigments for staining, then strain and thin with more turps for use. The nature of the flatting process I have already explained: but you must attentively notice that I must now take each colour right along each flank; first, the light terra-cotta next to ceiling; then the green-grey (recessed) portion; and lastly, the bottom division of warm colour. Were I to bring all three colours along at once, the joints would invariably appear shiny, the effect of which, at intervals of every five or six feet, would be most disagreeable, and would spoil the repose of the entire cornice.

Flatting requires to be *very* expeditiously manipulated, and the brush must not touch it a second time after leaving it and it once commences to set, which is within a few minutes. When a large mass of wall is flatted, the colour must be spread entirely over it at once; so that, single-handed, I do not attempt more than the cornice in this lesson. If any small portions of a large space are missed in the flatting, the wall is spoiled, not so much by the colour of the part missed, but by the bright oily gloss of the ground. Notice that I use the flatting much thinner than the oil paint—almost like milk—taking special care to coat all recessed as well as prominent portions, so that it all dries as dead and solid as the pink distempered ceiling.

All danger of splashing now being over, I give the walls a final rub down with No. 1½ glass-paper, and finish them with my lighter tint of sage green, prepared as before, but with two-thirds oil to one of turps, which dries with a good medium gloss, and gives me plenty of time to spread it and lay it off.

Ceiling, cornice, and walls are now finished and dry, so that the skirting and woodwork alone remain. My colour for the latter is already made, but requires the addition of terebine (which is preferable to white driers in compounding this paint), in proportions of one of terebine to twelve or fourteen of pigment. I thin sufficient of this with two parts turps to one of oil; then, having already carefully rubbed down and faced up the work (taking special care not to rub the previous coats off the sharp edges of the mouldings), I coat it on the system previously explained. The light, panel paint is first spread, covering mouldings also this time; and then the brushes are well worked into the dark, "Arabian brown" colour, and the remainder is painted, skirting included. On the following day we find our third coat quite hard, so I finish it right off with the remainder of our thick mixed paint, but made to working consistency with reversed quantities of liquids (namely, two-thirds linseed oil to one of turps), leaving until the next day the picking in of panel mouldings with the sage green wall-colour.

Let us now look around, and gather up the lessons this room should have taught you. There are the *proportions* of solids and liquids that go to compound both *oil*, *sharp*, and *flatting* paints for walls and woodwork. You have also a good notion of the *system* of working or manipulating them, as well as the methods of *thought* required i deciding colours, from which latter you have gathered that successful colour-results are *not* the outcome of a sort of inspiration—"taste" it is usually termed. Beyond this, you understand the *necessity* for clean and careful working, dusting the work, and well straining the paint, and thereby saving much time and glass-paper, on new wood particularly. As to the colour scheme of your billiard-room, perhaps its present appearance, after your being used to the rich variety (?) of black-and-umber drabs the builder has favoured you with, strikes you as being rather "loud." But wait, my friend, until the table is fixed in the room, with its pure green cloth, when our wall-colour will assume a warmer and much more sombre tone, making a fine background for a few good oil paintings in gilded frames; whilst the dark warm shades of the woodwork will correspond effectively with the mahogany framework of the table, and will suit equally well with any other articles of furniture usual to a billiard-room.

I promised in the opening lines of this lesson to deal generally with mixing colours for oil-painting, and to this end I will devote the remaining space allotted to my paper.

In these days of cheap paperhangings and materials it is the usual method for a client to choose a wall-paper, and then desire the woodwork to be painted to match—that is to say, in tints corresponding with the paper. In these cases, and for bedrooms especially, the painter will get good results by making the bulk of the woodwork a deeper shade of the predominant colour of paper. For instance, if the pattern is in soft green shades upon a cream ground, I should paint the panels cream, the remainder soft green to match the walls, and, as we should probably get a few touches of pink amongst the pattern, I should pick in the mouldings with a lighter tint of similar colour. Unless the paper is dark in appearance, it is generally advisable to put darker shades on the doors, etc. When such is the case, however, fairly light colours will suit a dark paper the best. The object in view is to make the doors and structural features of the room to stand out distinctly, but yet harmoniously, from the walls.

For practical house painters, the pigments I have previously described are the best, cheapest, and easiest to manage. Let me here point out the meaning of a few colour-terms, which are seldom properly understood even by operative house painters—namely, *tints*, *shades*, and *hues*. I take a little vermilion, for instance (which, you know, is a bright, rich, and rather costly red pigment), and to this add a little white lead. The resultant mixture forms a *tint* of vermilion—call it "coral," "blush rose," or any other fanciful name you please. If I further lighten the colour by adding white, it still remains a *tint*. Suppose, however, if, instead of adding white to the vermilion, I substitute a black pigment, the result is a darker mixture we should call a *shade*. By the term *hue* we understand what is predominant in a colour, such as a *blue hue* of green—that is, nearer the blue than the yellow, both of which it is made from. "The *roseate hues* of early morn" is a

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sentence that fully explains the word. It will, therefore, be understood that to speak of a colour as being a few *shades lighter*, or of a *darker tint* of colour, is altogether incorrect, and is certainly more than a matter of passing mention.

Before the painter can properly and confidently mix colours, he must be familiar and "carry in his eye" (so to term it) the appearance of all his pigments, so that when a colour has to be matched he can at once analyse it and judge what are the best pigments to use for it, subject to the other considerations of cost and permanence I have treated upon.

Suppose we try a few examples. I want to make a very bright and pure *tint* of red. Vermilion is my brightest red pigment, and this will, therefore, give me tints far purer than the cheap Venetian red. So also with blue tints: ultramarine gives the purest blue, and chromes the brightest yellow. The same method is used in mixed or compounded tints: we work with the brightest blue and yellow to obtain bright greens, although none such can approach to *emerald green* in this respect. All the useful variety of cream, buff, fawn, drab, stone-colour, ivory white, and terra-cotta colours, and so on *ad infinitum*, can easily be made from white lead and the yellow and red pigments of Venetian red and ochre, with burnt umber to tone or soften them down, and, occasionally, chrome and vermilion for the brightest kinds. Black with white gives us *grey*, neutral tints, and, with the further addition of blue, green, or red, we obtain all that class of cool *greys* known as French grey, silver-grey, green-grey, and so on, according to the dominant tint of colour displayed to us, and all of which a careful student of my papers should now be readily able to mix, providing his own vision is colour-perfect.

In my next paper the subject of distemper, or *tempera*, painting will be practically explained, this elementary series of papers being completed with a chapter on painters' tools and brushes.

SMITHS' WORK.

BY J. H.

About Grilles, Gates, and Screens.

A GRILLE is an open grating or lattice-work in metal, and is used as a protection to a tomb, relic, or shrine. In the Middle Ages a great deal of labour was expended on these works of art, so that they exist in very great diversity of form, and possess very often a great ornate development. A screen may be regarded as an assemblage of several grilles arranged in panellings; or it may be composed chiefly of foliage, with little or no duplication of parts. I cannot give an illustration of an entire grille or screen, but will only note in brief some of the details of their construction.

The illustrations here given (for some of which I am indebted to Wyatt's "Metal Work") represent some of the details of the construction of a screen from the Church of Santa Croce, in Florence. It is the most elaborate and perfect specimen of smiths' work in Italy. It was erected in 1371 by the Runuccini family, in honour of the Virgin. An examination of these figures will give a tolerably clear idea of the methods of union adopted. These methods of union are not apparent in front view; they must be looked for behind. The use of solid bars is well illustrated in each of these sectional figures. All the fastenings of bars and mouldings are not clearly seen, but the hinder views of portions of the gate clearly indicate the use of rivets. Thus the circles (A, Fig. 10) forming the panels are plain bars of iron, to which the mouldings are riveted (see section Fig. 11, A). The quatrefoils, B (seen in section Fig. 11, B), appear to form part and parcel of the circles, or they may possibly be attached by welding; but there are no rivets apparent. It would be possible, by slitting the bar forming the circle, to bend round strips to form the quatrefoils; or alternately the quatrefoils might be prepared, each separately, and welded at the cusps, C, or prepared as a whole and welded to the circles. Short scarfed joints might be made, or butt-welds, the metal, perhaps, being upset a little for the making of a good joint, and the superfluous metal filed off afterwards. The cusps, C (Fig. 10), are apparently welded on to the points of the quatrefoils.

The circles of the panels are united to each other and to the standards and transoms (Fig. 10) by means of dogs, D, which must evidently be riveted into holes countersunk on the front face. There is no attempt to conceal these fastenings at the back—all are visible; but in the front the points of junction are all hidden by little rosettes or star-like bosses (Fig. 12, A), prepared separately, and apparently welded or dabbed on. Thus the necessary method of union is made an occasion for the introduction of ornament. In this respect the panels would lack the rigidity of a cast-iron structure. But the screen does not depend for rigidity upon the panels, but upon the framework. The bars of which the structure is composed form an overlapping and crossing series, one bar binding others, and all riveted together in detail.

Some idea of this crossing of bars and mouldings may be gained from Fig. 11, C, which represents the building up of one of the vertical standards. Note also in the hinder view of a portion of the arch of the gateway (Fig. 13), which belongs to the screen of Santa Croce, how the various parts are bound securely with rivets and "fish-plates" (if we may use the term), while a stiff bar riveted right across ties the sides together, and affords a rigid backing for the mouldings.

We note also how the aim was to simplify the details of construction as far as possible consistently with the strength and beauty of the design. In no case is a moulding formed on a main bar where it can be formed equally well on a smaller supplementary bar. Not only in the larger sections, but also in the very smallest, such as those forming the tracery of the gate (a portion of the back of which is seen in Fig. 13), the mouldings are formed on bars distinct from those which constitute the skeleton, or light backing, or framework itself. This is the more noticeable as in all the tracery-work the mouldings have to be bent to such curvatures as would make them precisely concentric with their plates, so that the same margin of edge would show all around when the moulding and plain bar were bent and riveted together.

Thus in Fig. 12, B shows the section of the moulding of the portion A in Fig. 13, and Fig. 12, C, the section of the portion B in Fig. 13. To us, with our rolling-mills ready to turn out almost any sections to order, this method of bending mouldings and their bars distinct would appear a sad waste of time and labour. All the more reason why we should honour the men whose skill conquered the difficulties of hand work, and produced such beautiful examples of simple handicraft.

A beautiful example of a bit of work which must have occupied a vast deal of time is seen in the ribbon of the twisted shafts of the gates. A portion of one of these shafts is seen in Fig. 14. This twisting is prepared as a moulding, seen in section, Fig. 12, D. The centre piece of the shafts is a round bar, and the mouldings being bent around this, and meeting square edge to square edge, give the twisting whose effect is so beautiful. How many times one of these bars must have gone into the fire, how very many minute settings must have been required before the precise amount of twist was obtained, all kinks removed, and the ribbon-like moulding made not only to fit closely around the central bar, but also against the contiguous ribbons, three of which were required to complete the twisting, like a triple-threaded screw!

The more closely we look into these works, the more we see to admire. They are like great paintings: the more prolonged the study, the more vividly do their beauties impress themselves upon our mind.

It must have been a most tedious operation to build up an elaborate piece of work like the screen and gate, bits of which are seen in Figs. 10—14. Drawings, templets, swages, dies, must have been made, and every bit of iron must have been wrought upon the anvil, and between swages to its proper section, before any of the more artistic work was done. Probably some of these repetition tasks may have been allotted to subordinate and younger workmen. Though much of the beauty of some of these structures is largely due to their light appearance, yet a closer study reveals the fact that constructive strength has not been sacrificed. In some details we seem to meet with unnecessary mass. Many mouldings that we should stamp out of sheet-iron are formed in solid bars. And this, it must be remembered, was the practice at periods when iron was very precious, and every bit used was smelted with wood charcoal.

A curious illustration of the value of iron appears in a French book, written by one Mathurin Jousse, bearing date 1627, in which he advises the aspirant to begin to forge things in lead, so as not to waste coal and iron in his first attempts. By the way, I cannot see wherein the wisdom of this advice consists, or how the bending of lead can in any way aid in acquiring the knowlenge of how to bend iron. But in the Middle Ages iron was very dear, and was sold in bars of about four pounds weight each. Steel was about four times dearer than iron—in England at least, and probably also abroad. These bars were usually purchased at the great fairs; and on the farms the bailiff kept them in stock, and served out the quantity required by the local smith to fashion what was needed. It was owing to the great cost of iron that cart wheels were frequently cut out of a solid trunk of a tree and unprotected with iron, and that oaken pegs were substituted for those of iron in the rude harrows of that period. Spain was the principal source of foreign iron. Because of its cost it was chiefly reserved for ecclesiastical service, and for arms and armour.

There must necessarily have been many months of labour expended on such tasks as these screens and gates before any considerable show of erection was made.

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Long time must have elapsed ere the conception of the artist began to grow into shape. Impatient these artists must have been sometimes to see the realisation of their ideas; but they were, nevertheless, severely careful not to let "raw haste" become "half-sister to delay." Every portion was carefully secured, each minute detail finished, as though that alone were the object of their care; and strength as well as beauty were regarded.

Identical methods were not followed in works of the same class. In some grilles the quatrefoils were made in bar-iron, bent and riveted together, as in that of Santa Croce just noticed. But in others a simple method was followed. Thus a grille in the

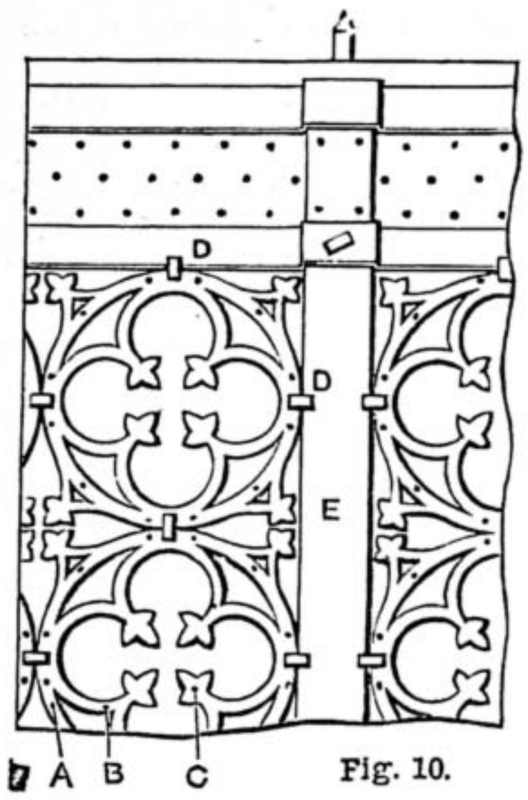


Fig. 10.

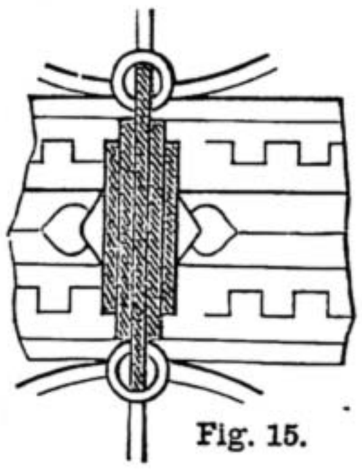


Fig. 15.

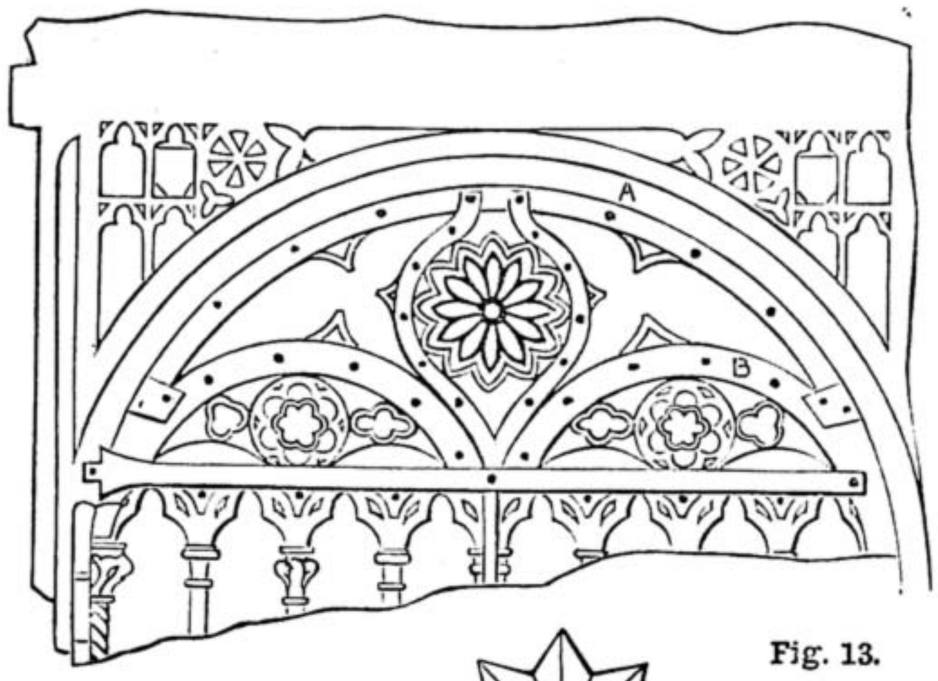
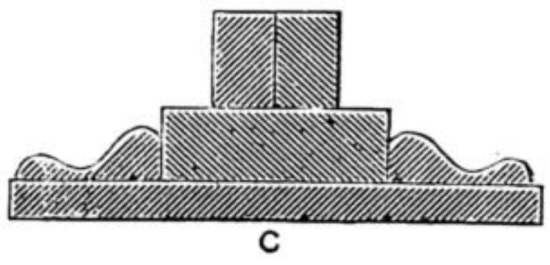


Fig. 13.



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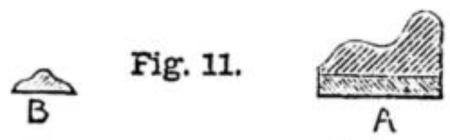


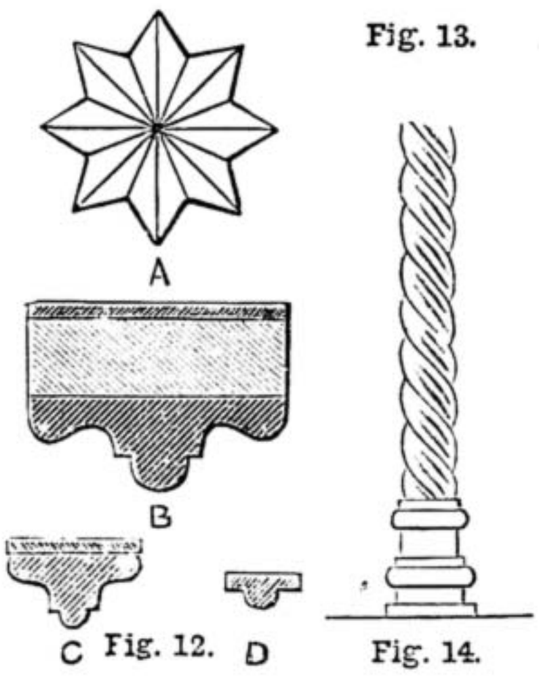


Fig. 12.

Fig. 14.

railings which enclose the monuments of the Scaligers at Verona is made of sheet-iron. The quatrefoils are cut out of the sheets and riveted to each other. This was a cheap method, and lacks the strength of those made of twisted bars. The effect is, nevertheless, very pleasing. An excellent example of the method of building up with solid bars is shown in Fig. 15. This represents a portion of the framework of a grille of fourteenth-century date in the Chapel of the Palazzo Publico, Siena. The section (Fig. 15) is seen to be composed of five plates symmetrically arranged. In two the edges are notched for ornament.

There are some comparatively recent screens made by one

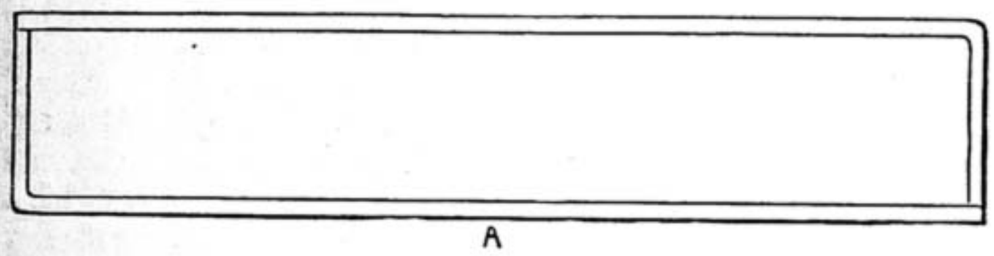


Fig. 16.

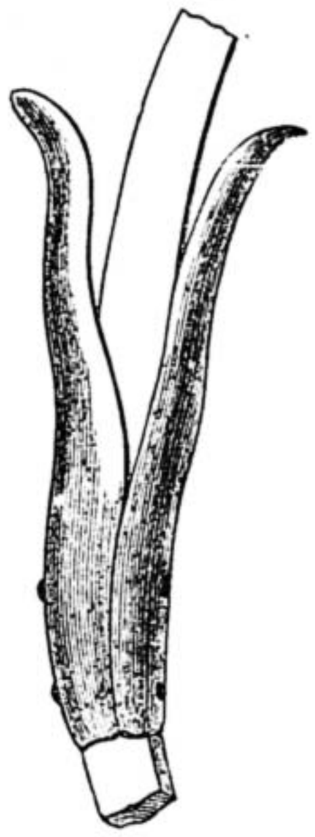


Fig. 20.

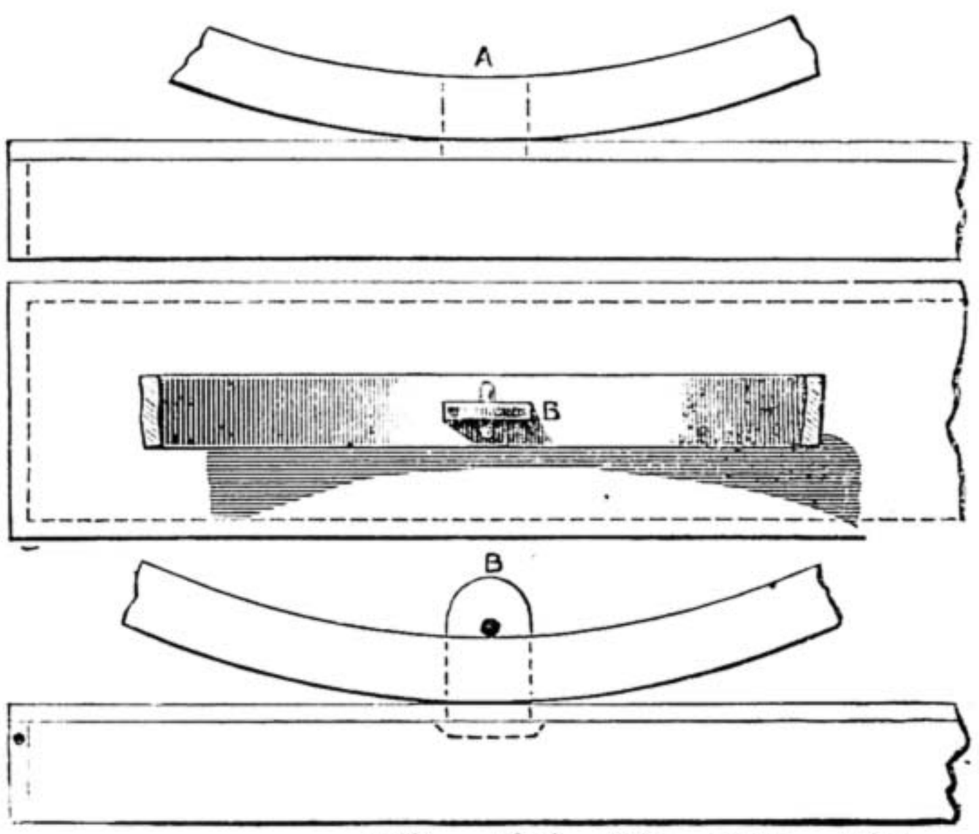
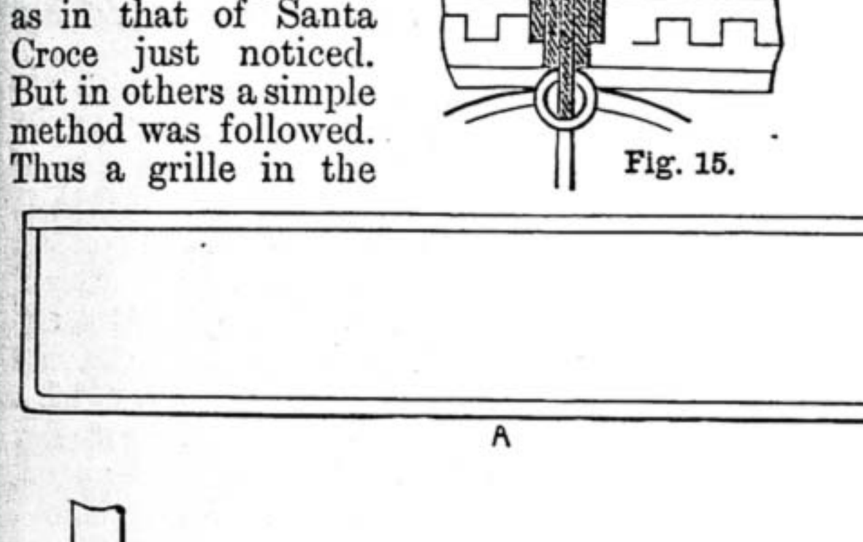


Fig. 17.



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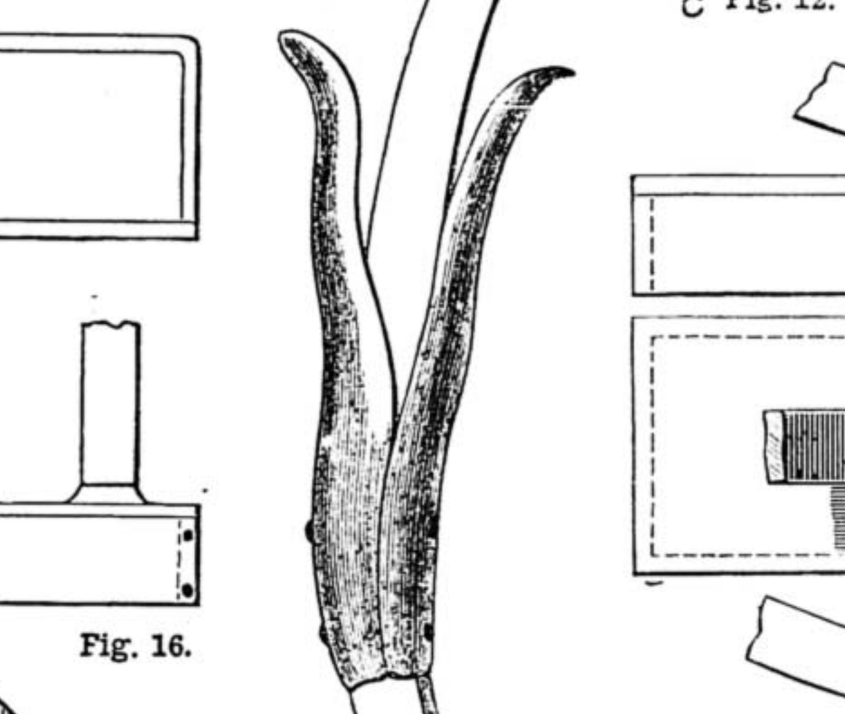
Fig. 21.

Fig. 18.

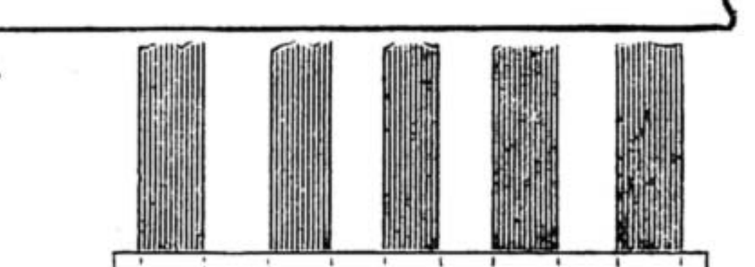

Fig. 10.—Quatrefoils of Screen, from the Church of Santa Croce at Florence, seen from the back. Fig. 11.—Details of Fig. 10. Fig. 12.—Sundry Details. Fig. 13.—Portions of Head of Gateway in Screen of Church of Santa Croce. Fig. 14.—Portion of Shaft of Gateway of Screen. Fig. 15.—Framework of Grille in Section. Figs. 16-21.—Various Details of Screens by Huntingdon Shaw.

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Huntingdon Shaw, a blacksmith of Nottingham, about 1695, for dividing the gardens of Hampton Court Palace from the Home Park, which are now in South Kensington Museum. Their appearance is more attractive when viewed from a distance than when examined closely. There is a vast deal of work put into them; yet for excellence of finish they cannot compare with some of the mediæval screens. This is largely due to the action of the weather upon them, and to general neglect. The wealth of foliage with which they are covered is marvellous. From these screens I have taken a few illustrations, showing the method of union of parts, and with these I must conclude this article.

The heavy-looking horizontal bases, measuring about four inches square, are really made of comparatively light plates, bent round and riveted at opposite corners (Fig. 16, A). Upon these rest other plates, B, supporting the pillars, between which scroll-work is carried. Some of the larger scroll-work is united to the bases in the manner seen in Fig. 17. A broad thin tongue, or tenon, B, passes from the base through the scroll-bar, and is secured with a pin. In some cases the tenon only is used (Fig. 17, A), without the pin. Where a number of bars are running parallel for a little way previous to diverging into scrolls, they are united with a band or loop (Fig. 18, A). The loop, being large, is then made of four pieces, each of nearly semicircular section, and riveted at the four corners. Fig. 19 shows the union of three pieces with a riveted loop, A, B, and also the spreading outwards of the terminations of the scrolls. Fig. 20 shows leaves partly encircling the bars, and united thereto with rivets; and Fig. 21 shows broadly-expanded leaves spreading over the bars and riveted thereto, and fluted as *repoussé* work.

WHY MY GAS-ENGINE WON'T GO.

BY F. A. M.

Lubrication of Gas-Engines.

Is any one ambitious to make a gas-engine? Castings may be bought, and the work is not very difficult to one who understands and can make a steam-engine. The gas-engine, however, is not so well understood as the steam-engine, and many who have undertaken to make one have failed to get it to work, and have had to sell it as "partly fitted." I have made a model gas-engine, 1½ in. diameter, by 4 in. stroke, and it goes pretty well. I had to look up the subject, and found some difficulty in getting the information required, especially certain practical directions, simple enough when you know them, yet not contained in any book with which I am acquainted.

My first intention was to write a paper on "How to Make a One-man-power Gas-engine;" but I find the cylinder of this is rather large, and the crank shaft too large to be turned upon a 5-in. lathe; and, altogether, the amateur would probably have to get a good deal of the work done for him. Having applied to the maker of my engine for leave to publish working drawings, I could not obtain it; instead, therefore, of describing the construction of any particular gas-engine, I intend to try to give a few practical hints such as I found the want of myself, which may, perhaps, be useful, not only to those who have made gas-engines and cannot get them to work, but to those who have bought a gas-engine and find it "so uncertain."

Beginning at the beginning, I will deal only with the *non-compression*, or simplest form of engines; their action is briefly this: the fly-wheel must be turned by hand to draw the piston partly up the cylinder; the exhaustion underneath the piston opens valves over the air and gas inlets and sucks in both air and gas; besides the valve on the gas inlet, there is also a cock, which enables the quantity of gas to be regulated till it becomes about one-tenth of that of the air. Having thus drawn in the explosive mixture by raising the piston about two-fifths of the stroke, the piston, continuing to move, uncovers a hole made through the side of the cylinder, called the ignition orifice; from this moment the piston draws in at three places instead of two. Now, the ignition orifice is covered by a little hanging flap valve which opens inwards, and against the outside of this orifice there plays a constant flame. The moment, therefore, the piston passes the ignition, the suction of the piston opens the little hanging flap and draws in flame; the flame ignites the mixture of gas and air in the cylinder, which instantly becomes full of blue fire, the heat of which expands, momentarily, the contents of the cylinder and throws up the piston. All that remains of the cycle of operations to complete the revolution is, that as the crank turns the upper dead-centre and begins to come down, a valve must open to allow the burnt gases in the cylinder to escape; this is simply managed by an eccentric and slide valve.

For the sake of my younger readers, I may say that gas alone will not explode any more than pure air will; if you could strike a match inside a gasometer, it would simply go out! If you could introduce a jet of air into the gasometer, and light it, the air would burn in the gas, just as we now see gas burning in a jet in our rooms. What we call "burning," is simply the rapid combination under heat of anything with oxygen; thus the flame appears, and the burning takes place where gas and air meet and heat is applied. Air contains oxygen. Now, there are two ways of burning gas. One is to mix together the gas and air gradually, applying heat all the while; this is what takes place when you turn on the gas tap and apply a match to the burner; the gas mixes with the air of the room, the application of the lighted match supplies the heat sufficient to cause the rapid combination we call burning, and afterwards the combination is effected by the heat of the flame itself. The other way is to mix the air and gas in the proper proportion and then apply the heat by a light; this causes the combination to take place all over the mixture at once; it is just what occurs when a tap has been left on at night, or an escape has occurred, and the gas has gradually mixed with the air in a room; in the morning, the servant comes in with a candle and—you know the result, there is a fearful explosion. Now, what has taken place? Simply this: the room was full of air and gas ready mixed—the flame of the candle lighted the whole mixture at once; it became full of flame, and increased in a moment by reason of the heat to three or four times its former volume; no wonder if the window was blown out! The room was converted for the moment into the cylinder of a gas-engine, whilst the window or door was the piston. Now, in the gas-engine, we produce a gas accident on purpose every revolution; the explosion gives one strong, but almost momentary, impulse; it occurs about the middle of the up stroke, driving the piston to the top of the cylinder, the connecting rod acting something like the leg of a man who should give the crank a good strong kick just at mid-stroke; this will show why the cylinder of a simple or non-compression gas-engine requires to be so much larger than that of a steam-engine of equal power.

It is only when combined in certain proportions that gas and air will explode. About six of air to one of gas is the richest mixture that will give an explosion; if more gas than this is getting in, the engine will not work, and you can find it out by putting a lighted match to the exhaust while turning the wheel; if you can light the exhaust, the engine is getting too much gas. About ten or twelve of gas to one of air is the weakest mixture that will give an explosion when uncompressed, but the explosions of a weak mixture are less powerful than those of a stronger mixture, so that when a governor is applied, it can, by cutting off some of the gas, weaken the explosion, or by cutting off more, stop the explosion entirely for one revolution or two, so as to bring down the speed to normal rate.

Speaking of my own experience with the model gas-engine, many seemed to think it impossible to get so small an engine to work at all, and it appears to be admitted that it is more difficult to make a little one go than one of one-man-power. However, after a few minutes spent in regulating the gas tap to give the correct proportion of gas, my little model went off at the first trial. After running with the cylinder quite dry for ten minutes or so, I tried oiling the piston, and then my troubles began. Nevertheless, I am glad of this now, for it was the means of teaching me many things I should not have known if all had gone well from the beginning.

This leads naturally to the first reason why the gas-engine may fail to go. It will not go long if the piston is oiled. The reason for this is very simple: the heat in the cylinder at the time of the explosion is considerable, quite enough to carbonise the oil, so that instead of a lubricant you have a black sticky deposit; you put more oil and the piston is free for a few strokes, when, alas! the same thing occurs and you have a thicker coat of gum to deal with. The only way to deal with it is to draw the piston and clean both cylinder and piston with paraffin. Instead of oiling the piston make a paste of paraffin and black lead, and apply this with a paint brush to the inside of the cylinder; the heat will quickly evaporate the paraffin, and the black lead will lubricate the cylinder.

Now comes the second hint. On coming back the next day to make further experiments with the gas-engine, it was found to be set perfectly fast; the wheel could not be turned, and both the piston and slide valve proved to be firmly fixed. This was caused by rust; there was nothing for it but to soak in some paraffin to dissolve the rust, disconnect the parts, and continue rapping on the piston and valve, adding more paraffin, till the parts were again free. This accident can be very easily prevented by putting a very little oil, *after the engine has done working*, to both piston and slide valve, and then turning the engine round three or four times, just to spread the oil upon the rubbing surfaces; it is well to wait a little while, to allow the cylinder to cool somewhat, before adding the oil.

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SIGN-WRITING AND LETTERING.

BY HENRY L. BENWELL.

PRISMATIC LETTERS — ORNAMENTAL LETTERING — CHURCH TEXT — ILLUMINATED CAPITALS — MEDIÆVAL ALPHABETS — SCROLLS — PULPIT PANELS—ZINC.

THE last chapter concluded with a reference to the sunk or incised form of letter, but it was merely mentioned there in its plain style only, *i.e.*, as a square sunk letter. I had forgotten to say that in these letters the "depth" is here the same, or the equivalent of the "thickness" in raised letters, but in addition to this, there are the shadows and reflections which must have careful "putting in" to obtain the desired effect. I should also add that the light is best made to fall on the side visible to the spectator, which will, of course, be in the highest light and the opposite in shadow. As the letters are also often viewed from below, the revealed parts at top and bottom should also be in shadow, and also because the light principally strikes down from above.

Prismatic letters are another class of the incised series, but are of a more elaborate nature, and, consequently, harder to produce successfully. The great aim of the writer is, or should be, to deceive the sense of vision, and as this is easily done, he is but a poor workman at his chosen art if he fails. This deception of the eye is the one great principle which underlies the sign-writer's art, and it entirely depends upon its successful or unsuccessful handling whether the art workman becomes *facile princeps* at his craft or otherwise. It should be the sign-writer's greatest endeavour to secure this faculty, which, with adroitness, decisive will, and skill, is the making of any man in this walk of the minor arts.

I now leave the plain alphabet with which we have hitherto concerned ourselves, and turn my attention to ornamental and ancient letters, church text, etc.

The letters which form the various styles of plain alphabets comprise the groundwork for most of the ornamental and other alphabets, and if the student has fully mastered the earlier series of letters, he should by this time be ready to approach with success the more difficult combinations which a first-class sign-writer is called upon to produce. Mr. Callingham thus discourses respecting this item:—"It is here that the genius of the painter is most severely tested. In order to execute the comparatively simple forms of the Roman, sans-seriff, and Egyptian alphabets satisfactorily, great neatness and finish are demanded. The angles should be clean and true, the various vertical and horizontal lines straight, the parallel lines regular, and the curves well poised. A considerable amount of dexterity is necessary to attain perfection in these particulars, and it can only be acquired by much practice. But, beyond this, when the learner comes to the more difficult accomplishment of ornamental writing, he must familiarise himself with the general principles of design; for obviously a good painter will not always rest content with copying the productions of others, however much they may have in them that is worthy of imitation." What valuable information and advice is this, and how it stamps the man as one who has his work thoroughly within his grasp and knowing also by what means it is to be—and has been by himself—obtained.

The great point to aim at in ornamental lettering is originality, and in this matter the field is practically boundless, there being really no limit to the forms which may be given to the alphabetic characters. At the outset, however, it is necessary to guard the beginner against an extravagant use of ornament. As a general rule, it should be simple rather than complex. And whatever style of embellishment be decided upon, care should be taken that it does not detract from the legibility of the lettering; for, if it have this tendency, the result can scarcely be deemed satisfactory, as it must be borne in mind that the writing has to serve a practical purpose, to which in the great majority of cases the decorative accessories are subordinate.

The style of the lettering, too, must in all cases be in harmony, and upon this matter Sir Matthew Digby Wyatt, who took such an active part in the decorative work of the great Exhibition of 1851, remarks with special reference to form and period, that "there are few faults more common in modern work or more offensive to the educated eye, than the association of styles of lettering and styles of ornamentation warring with each other in the properties of both time and form."

When the pupil has become an adept in the plain styles of lettering, he will find it anything but hard to strike out a fresh departure and introduce fresh and graceful lines into these letters, ornament their faces, etc., and thus beautify them by several degrees. He may get many suggestions in this way from a type-founder's specimen book, and it is from these that the writer has always worked out and adapted any ornamental alphabets he may have required. I must point out, however, that it is only a slight proportion of printers' type designs that are suitable for sign-writing purposes, and these are mostly to be found in the ornamental founts. The specimen books mentioned only contain a few letters, generally a couple or so of complete words, and for those who are so backward in self-reliance as to need every letter of the alphabet, I must recommend the books sold for the special purpose. I have heard that the books of alphabets by Delamotte, and published by Crosby Lockwood & Co., are very useful, but strange to say, I have never seen them, much as I should like to; still, they ought to be in every sign-writer's library, so here they are:—1, "Mediæval Alphabets and Initials"; 2, "Examples of Modern Alphabets"; and 3, "The Book of Ornamental Alphabets." Messrs. Brodie and Middleton have also several books of a similar kind, from one shilling upwards, but these also I have never seen, so cannot recommend them nor condemn them. The alphabets given in the last chapter are specimens of ornamental letters, but there is another and even more comprehensive style, which is known simply by the name of "Ornamented." Other varieties are known as Open Ornamented, Open Tuscan, Classic, Runic, Rustic, French, and Italian, and the alphabets incidental to every century; but enough have been mentioned to illustrate the wideness of the field of selection and the scope for a suitable display in every direction. I have found it impossible to give as many alphabets as I could wish, but those which I have given I have distributed throughout my series of papers as far as I have found it practicable to do so, knowing as I do their great utility to the aspirant for sign-writing honours.

I have purposely left church text out of the above list, because it requires separate treatment at my hands, and I will now endeavour to compress as much useful information as I can into the small space left at my disposal. We all know the vast amount of work which is done in this direction within the walls of our churches, and I believe it is work of the highest remunerative description. Much of it I know borders on what is a separate department of art, *i.e.*, the art of illuminating, but I presume a good sign-writer can and does take up certain classes of this work, and if he does not, one may well ask, Why not? His previous training should eminently fit him for such work with very little extra study and preparation, and he may surely rely upon self-help and self-tuition as far as it is needed. I can only say that if the young sign-writer takes up this branch of decorative art, it will be the means of considerably augmenting his income, and it is for this reason I am urging him to give it his most intelligent consideration.

For inscriptive texts in churches, etc., the use of illuminated capitals (see Fig. 74, G) and mediæval lettering (see alphabet, Figs. 72, 73) is now much in vogue. For ordinary purposes on plain painted walls, Scripture texts should be painted on the walls in two colours only, the capitals being red, red and black, or blue, and the small letters either red, blue, or black.

Of course, the colouring may be done in such suitable tints as would stand out best against the ground colour on the wall, but as stone colour is generally employed when a wall is painted, which is seldom, the plain colours look the most substantial and the best. I may say that walls are seldom painted; when they are, they are frequently treated in the polychromatic style of decoration, which is so noticeable a feature in many of the college chapels at Oxford and Cambridge. Here the lettering, of course, is more showy in order to be in keeping with the rest of the decoration. In employing the mediæval alphabets, it is necessary to make use of the various old style space ornaments and accessories (Fig. 74), such as quatrefoils, dots single and in clusters, stars, etc.

We frequently see in church texts each word divided with these ornaments or stops, which is, of course, a violation of punctuation, but as this was the method adopted by the olden time illuminators, it is still slavishly followed by modern members of the craft.

In this class of lettering, great care has to be taken not to mix the letters of one alphabet with another in the same inscription, or even in the same word, which is very apt to occur where the student has been practising with a great many alphabets of all dates and countries. To avoid this, he should always carry his specimen books—some of which should be of home manufacture—for ready reference.

I must warn the student against employing any alphabets antecedent to the twelfth century, as these are not intelligible to the majority of modern readers. Celtic and Anglo-Saxon characters the writer may have in his book, but only as curiosities and not for everyday use. He may, perhaps, require them when lettering some archæological object, and that is about all.

The great point to consider in church lettering is what alphabets to employ which shall be both readable and appropriate to the scheme of decoration in hand. Mr. W. Sutherland remarks that "Our ecclesiastical decorators are too much in the habit of stultifying themselves by using these unreadable letters simply because the same letters were used in certain manuscripts

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Fig. 72.—Mediæval or Church Alphabet: Capitals.

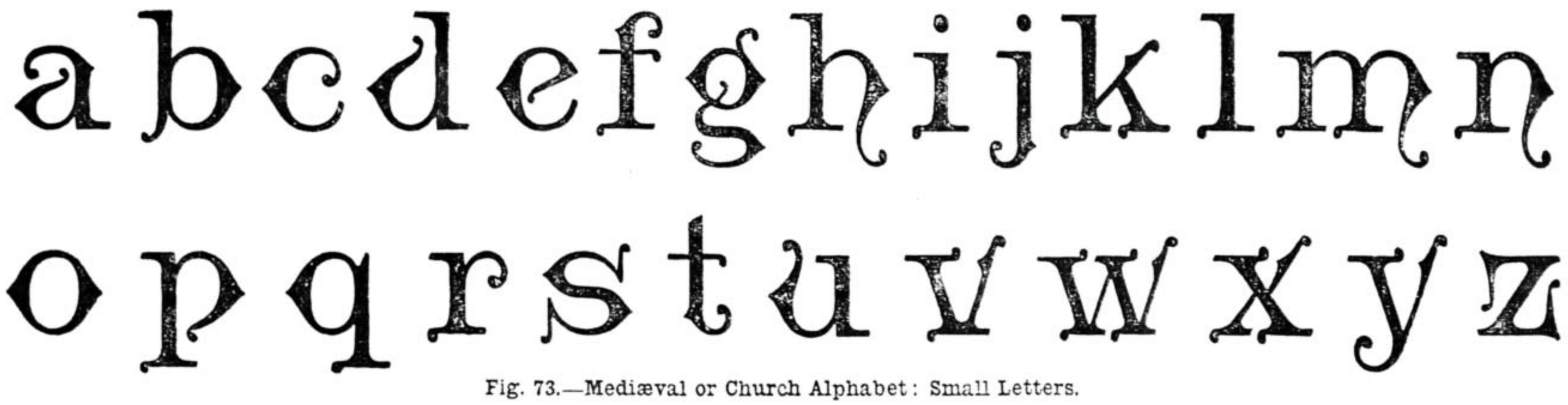

Fig. 73.—Mediæval or Church Alphabet: Small Letters.

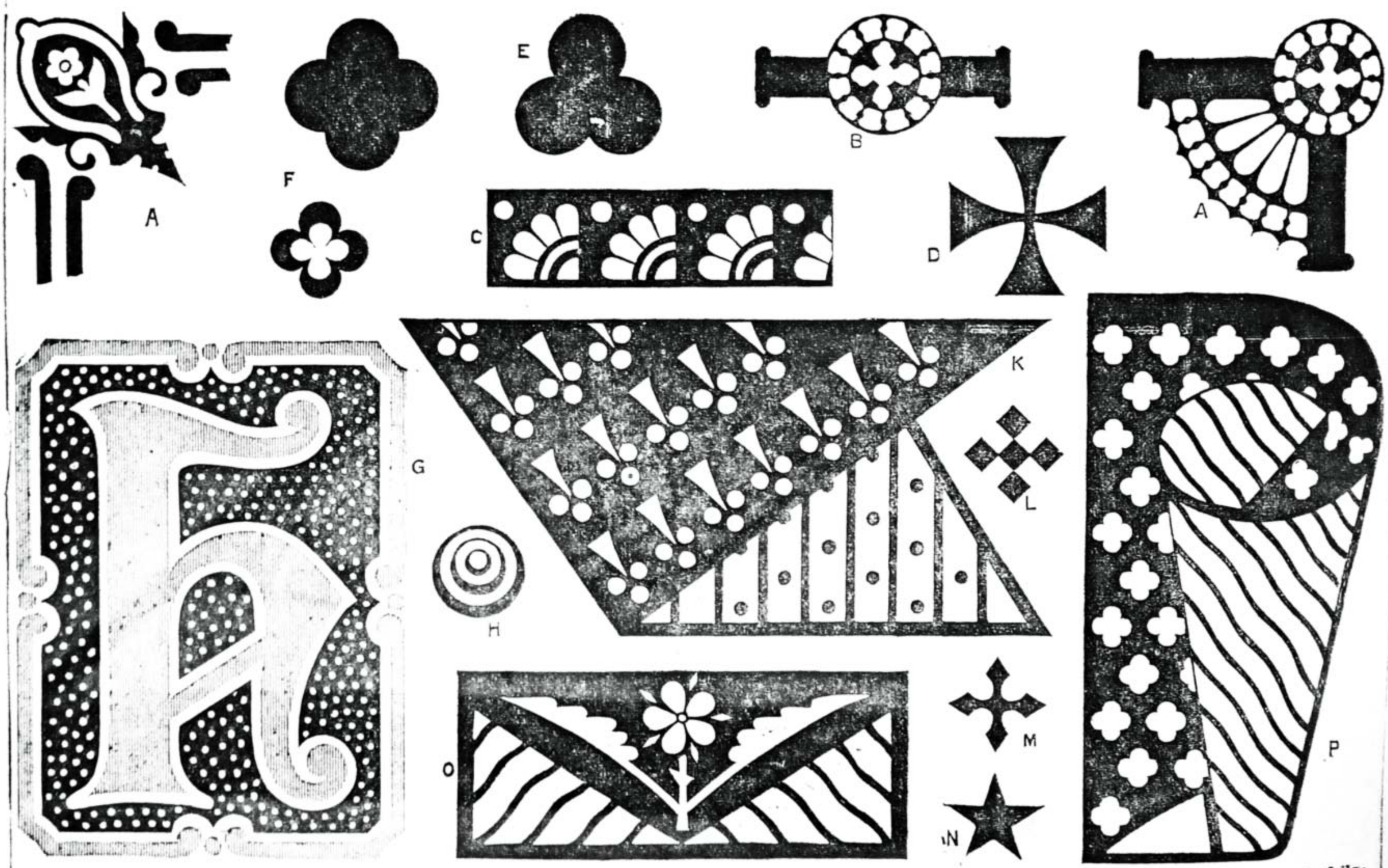

Fig. 74.—Ornamental Lettering and Ornaments for Church Work—A, Corners; B, Centre; C, Border; D, Maltese Cross; E, Trefoil; F, Quatrefoils; **G, Initial Letter**; H, Circles; K, Ribbon End; L, Diamond Cluster; M, Cross; N, Star (in Heraldry a Mullet); O, Tablet End; P, Scroll End.

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and certain churches at a certain period, and they consider any departure from this plan as a move in the wrong direction, forgetting, or, if not forgetting, ignoring the fact that at the time these letters were used in our churches the mass of the people were ignorant of reading and writing, and that it was only the learned, who were few and far between, who could read or interpret these inscriptions." In these days, when all can read and write, we want inscriptions that are decipherable by all, and this these obsolete alphabets are certainly not.

As much text lettering is frequently done upon zinc in the shape of scrolls, pulpit panels, etc., I append a receipt for the preparation of the zinc previous to painting.

To prepare zinc for painting upon.—In sixty-four parts of water, dissolve one part of chloride of copper, one of nitrate of copper, and one of sal-ammoniac, and add one part of commercial hydrochloric acid; brush the zinc over with this mixture, which gives it a deep black; leave it to dry for twenty-four hours, when any oil colour will firmly adhere to it and withstand both heat and damp. I am sorry that space will not enable me to give examples of these scrolls and panels for church decoration.

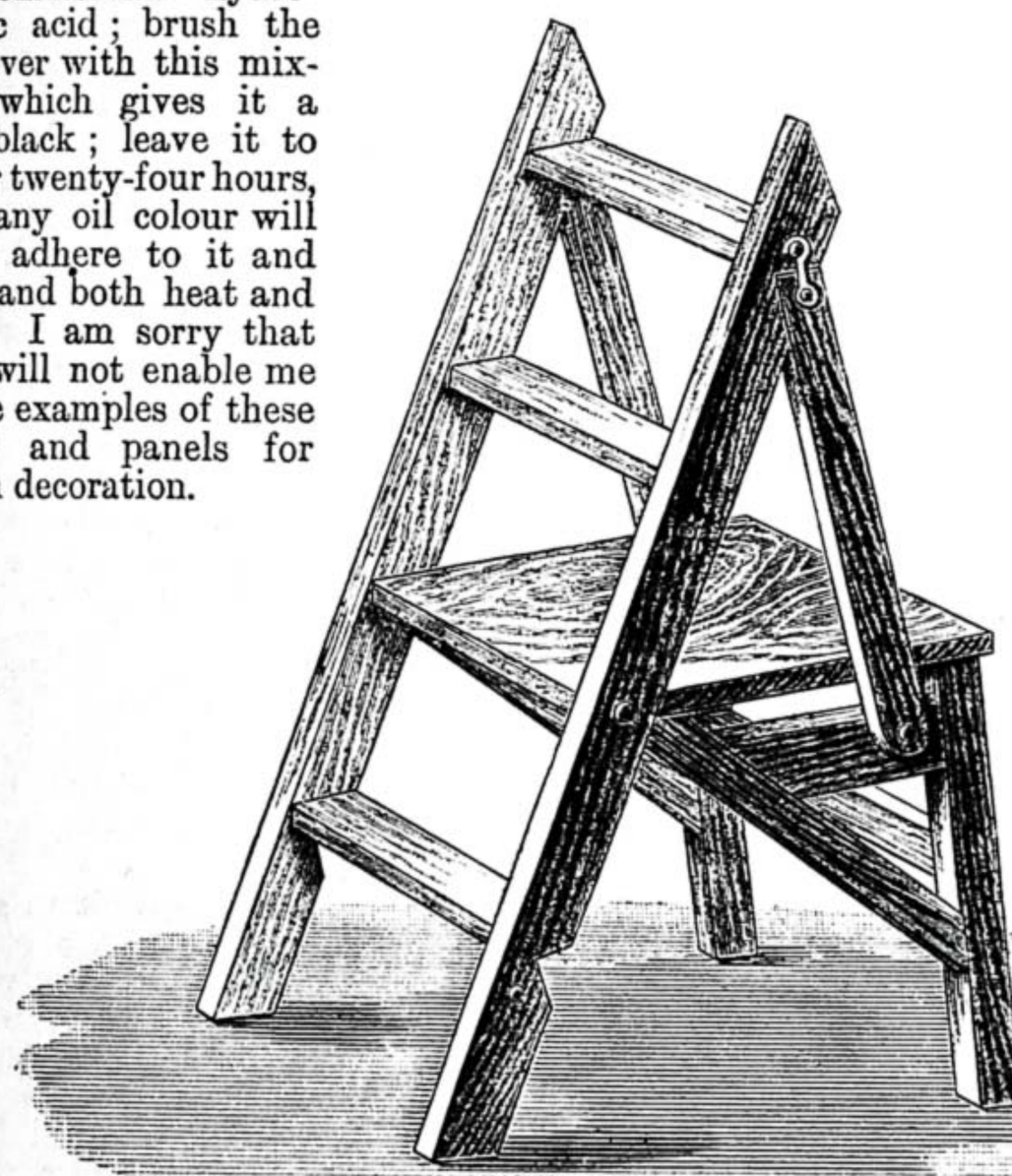

Fig. 1.—Step-Chair in Position for Use as Steps.

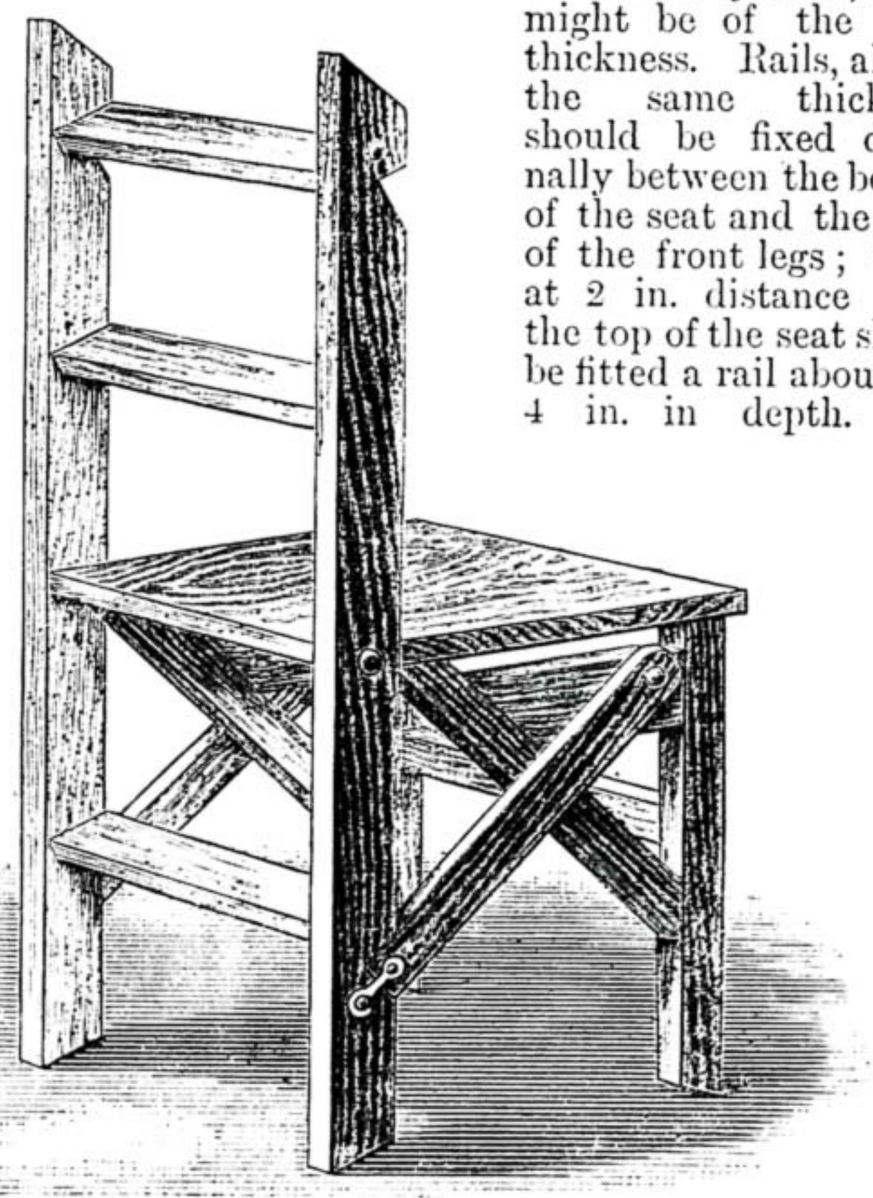

Fig. 2.—Step-Chair in Position for Use as Chair.

A STEP-CHAIR.

BY J. SCOTT.

EVERYONE knows what a step-chair is. It is a combined chair and pair of steps. For the library, such an article is of very great use, although much cannot be said in praise of its appearance, as the demands to be attended to in designing an article of this kind are such as prevent the introduction of curves; without which, beauty or prettiness can scarcely be obtained.

It is very often difficult to fathom whence a designer obtains his original ideas; they sometimes seem to spring from nothing whatever. In most of what are called original designs, nowadays, some feature or another is traceable to previous designs; and designing may now be said to consist of combining to advantage the improvements and most pleasing features that have developed from other men's minds, when there was a freer field for their imagination.

Whoever was the original designer of the ordinary step-chair—which is about the only one at present in the market—he could scarcely have had any suggestions from articles previously made, and the present result must have been one of those freaks of the mind that are frequently experienced by those who give up much of their time to designing.

My drawing shows a step-chair which, although I can claim a certain amount of originality for it, is merely a suggestion from that at present in the market. It has, however, a few advantages over its elder brother, and these are: that it requires hardly so much time, labour, and material to be spent upon it; and, although it may not be quite so compact and solid-looking an article as its relative, if made well, and in sound wood, it ought to be quite firm and substantial enough for its purpose. If any amateur reader intends to make one after this pattern, I should strongly advise him to go to some well-known and reliable wood-yard for his material, as, otherwise, some may be palmed off upon him which would be utterly worthless. I should, indeed, feel very sorry if I were to hear that one of our numerous friends had suddenly collapsed with the chair, while he was on the top of it reaching down some interesting book. I am afraid such a calamity would upset his desire for book information for some time, and also bring upon my head some undeserved accusations.

But it is not to be denied that great disappointment sometimes follows the purchase of what is apparently good sound wood. Not long ago I was watching a professional friend working up the back-foot of a chair with his spokeshave, when he suddenly came upon a very great defect, which was previously hidden from view. Of course, such things cannot be helped at times; but the chances of buying bad stuff are greatly lessened by going direct to a well-known firm.

In the article here shown, besides having good wood, it is a very essential thing to have thick and strong iron, steel, or brass pegs, to act as pivots upon which the back and side rails revolve.

Now for the sizes.

The length of each back-foot is 38 in., the width 3 in., the thickness 1 in. The bottom of each will have to be cut on the cant, so as to afford a firmer support for the job when used as steps; and for appearance' sake, the top as well might be so cut. The seat will be 18 in. from back to front, and 15 in. wide. It would be best, perhaps, if it were thicker at the back part than the front; say $1\frac{1}{2}$ in., and the front 1 in. It will then allow a sufficiently strong and stout peg to be driven into it. The front legs will be $1\frac{1}{2}$ in. square in thickness, and the sides of them must come flush with the sides of the seat; otherwise, the movable rail will not be able to work. It will not be necessary, however, to have them quite flush with the front of the seat. These two legs should be connected by a rail, which might be of the same thickness. Rails, also of the same thickness, should be fixed diagonally between the bottom of the seat and the back of the front legs; while at 2 in. distance from the top of the seat should be fitted a rail about 3 or 4 in. in depth. My reason for having this last-mentioned rail so deep is on account of the weight that will be brought to bear upon it. It will no doubt be seen that I show the pivot more towards the top than the centre or bottom, where it will be firmer.

Between the two back feet we have three steps, the seat forming the fourth. These steps should each be 15 in. long, and about 4 in. wide, by $\frac{3}{4}$ in. thick. They should be so fixed as to be in an horizontal position when the article is used as a pair of steps. Stout iron pegs should pass through the back feet, and penetrate the seat for a few inches; these are the pivots upon which the back feet work.

We now come to the movable side rails. These must be 16 in. long, $1\frac{3}{4}$ in. wide, and 1 in. thick. They work upon pivots which pass through them into the side piece, as I have shown in the drawings. Two notches must be cut in each back-foot, to admit the end of one of these rails. It will be best if the cutting of these notches be left until all the rails, etc., are cut out; their exact position can then be the better ascertained. A

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hook should be fastened, to work loosely, to the end of each of these rails; and an eye or nail fixed above the top notch, and one below the bottom. The steps will have a firmer support, perhaps, if the bottoms of the front legs are slightly canted inwards.

Allowance must be made in my measurements for joining, which will require a great deal of attention; as, unless well joined, it will soon become shaky.

Such a chair as I have just described is not a very comfortable one to sit in; but comparative ease can be obtained by using a cushion. This cushion should be made long enough to cover the back and seat together; and one end should be fastened to the top of the back feet, while the other is secured to the front of the seat, so that it hangs something like a hammock, only, of course, fitting more closely to the form of the chair. If this is done, it will be found that the cushion will in no way prevent the chair from working, as it will only be necessary to pull the middle of it up from the seat and back. Here, then, is another advantage, as a cushion cannot be so well adapted to an ordinary step-chair.

Thus I conclude my remarks of the step-chair; not "a thing of beauty, and a joy for ever," but a thing of ugliness, and of use for—not ever, but a long while.

PRACTICAL HINTS ON MOUNTING OBJECTS FOR THE MICROSCOPE.

BY A. T. SMITH.

MOUNTING IN CELLS — SEMI-OPAQUE OBJECTS.

MOUNTING transparent and semi-opaque objects in cells is the only subject which now remains for consideration. Cells, as we already know, are used for the purpose of preventing the object from being subjected to pressure, and so crushed out of shape; but, as in the case of dry mounts, so with transparent objects—it is especially essential that the cell chosen should be of the right thickness. This is even more important in the latter than in the former case, because if the mounting medium used is a fluid, the object is exceedingly apt to slide about in the cell if the cell is in the slightest degree too deep.

The choice of materials for the cell walls is also more limited, as it is always necessary to make the cell wall of a material which is not porous; if it is, the medium will, of course, leak through it.

Books on the microscope recommend, in many cases, "built up" cells—that is to say, cells built up of slips of glass cemented together on the slide, but for practical purposes these are never required, so we will not refer to them further. I have always found the ordinary vulcanite or glass rings amply sufficient for any ordinary purpose, and if I have found it necessary at any time to use an exceptionally large cell for any particular purpose, I have cut one out of a piece of good sheet indiarubber and cemented it to the slide.

For cementing the cell to the slide, marine glue is, perhaps, one of the best cements to use, and in order to make the cell walls quite impervious, they should be coated with a thin layer of gold size after the cell is fixed on to the slide. The coating should extend just over the outer and inner edges of the glue.

Marine glue is, however, at times, somewhat difficult to work with, and I have found very useful the cements sold for sticking glass together (compounded mostly of isinglass and acetic acid).

The media used for mounting in cells are the same as before: viz., Canada balsam, gum dammar, glycerine jelly, Farrant, glycerine, and dilute glycerine; but it is particularly necessary in using Canada balsam to dry the balsam very thoroughly before dissolving in chloroform. Again, in using balsam, it won't do to use cells fastened on with marine glue, because the chloroform will act on the gold size and glue and spoil the mount. Cells fastened on with isinglass cement should be used with this medium, and after placing the object in position, it should be covered with a watch-glass and put aside, to allow the chloroform to evaporate, then more balsam should be added until the cell is quite full of hard balsam, when the cover glass may be applied in the manner described hereafter. Balsam labours under a great disadvantage, in so far that it is difficult to get it sufficiently hard and dry before applying the cover glass, and the result is that, after the cell is nicely varnished and put aside as finished, some fine morning you will find that the cover glass has cracked across or collapsed in the middle, which mishap has been

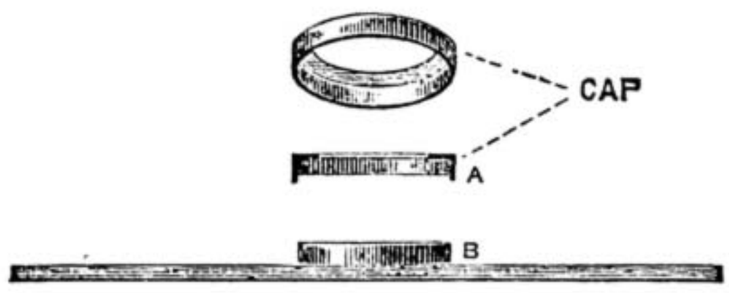

Fig. 4.—Cap for securing Cell.

A, Metal cap (in section), fitting exactly over cell wall, B.

brought about by the contraction, through further drying, of the Canada balsam.

Many of the fresh-water algæ, such as *Batrachospermum*, whose beauty is much impaired by pressure, look exceedingly well when mounted in a cell in glycerine jelly. They should be prepared by soaking in strong glycerine for a day or two previous to mounting, and as, in some cases, objects of this class are too fragile to stand even the slight amount of heat required to melt the jelly, they require to be mounted in glycerine alone, with a trace of carbolic acid, or even dilute glycerine, consisting of about equal parts of distilled water, pure glycerine, and a few drops of pure carbolic acid. It is here that the great difficulty comes in.

Glycerine, as we know, easily mixes with water, and therefore readily unites with most animal and vegetable secretions, but, for this very reason, has the disadvantage of interfering very materially with the effectual sealing up of a cell, because neither glycerine nor water will unite with anything of the nature of turpentine; consequently, if there is the slightest trace of glycerine or water in the top of the cell wall when you come to ring the slide with gold size, the gold size will not adhere at that point, and the result, sooner or later, will be a leak, which is undesirable. On the other hand, it is impossible to use a spirit varnish, because the spirit would run in at once.

The following very ingenious method of getting over the difficulty has been devised, I think, by Mr. Enoch:—

A small metal cap (see Fig. 4) is made to fit exactly over the top of the cell, and when the cover glass is in position, and as much of the medium as possible wiped away, particularly from the top and edges of the cover glass, a layer of gold size is applied to the edges of the same and the top of the cell wall, and then the little cap is placed over all. This holds the cover firmly in position, and the slide is placed on the turn-table, and a good layer of cement applied to the outside of the whole. If this is carefully done, and good gold size and indiarubber cements applied alternately, an exceedingly strong and neat cell is the result, and there need be no fear of breakage. As I have said before, the great thing is to see that all trace of glycerine or water is removed before applying the varnish.

Now concerning preparation and manipulation:

From the very nature of the case, objects suitable for mounting in cells cannot require much preparation. They must be altogether or almost transparent, to begin with, or, at any rate, quite capable of being easily rendered transparent by the ordinary methods of maceration in water, caustic potash, or soda.

Vegetable preparations will not, of course, stand much of this treatment; nor do they require it. Soaking in glycerine before mounting is usually sufficient, but preparations of insects, or portions of them, require careful and discriminating treatment.

Some of the very dark Coleoptera with hard carapaces require soaking, or even boiling, in strong potash or soda before being fit for mounting; others, again, with softer coverings, require only soaking. For some insects, again, the re-agents referred to are too strong, and pure carbolic acid must be used, and for others even this is too strong, and the carbolic acid has to be diluted with glycerine. This last method is the one used for preparing specimens of insects in their natural form and colour without pressure, and by it some very beautiful results may be obtained—the object being, after preparation, mounted in dilute glycerine.

It is often extremely difficult to get the object (say, the head of a bee or wasp) firmly fixed in the cell so that it will not move about, and this, no matter how careful we have been in selecting a cell of the right thickness. This defect may be remedied by taking a piece of glass tube and drawing it out to a thread. Now take a piece of this thread just the breadth of the inside of the cell, and stick it right through the object from side to side. If the ends of the glass thread are now placed against the inside of the cell walls, the object will be securely fixed in position, and a source of annoyance removed. The glass thread, when immersed in the medium, is not in the slightest degree unsightly, nor is it in the way.

It is far more necessary to be careful to exclude air-bubbles in mounting in cells than when mounting in the ordinary way, because they cannot be squeezed out. Hence, after filling the cell with the mounting medium, its interior should always be carefully examined, and if any air-bubbles are found adhering to the bottom or sides, they should be removed with the point of a needle. Again, as to filling the cell. There should be just enough medium in it to form a slightly convex surface when the object is immersed, and the object should be allowed to remain in the medium for a few minutes before applying the cover glass, in order to allow any air-bubbles that may be attached to it to rise to the surface. These should then be removed, and then the mount may be completed as follows:—

Take a clean cover glass—warmed, if the medium is Canada balsam—and, allowing the right-hand edge to rest gently on the

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top of the cell wall at the left-hand side, push it gently forward until it touches the medium. If there is the right quantity of medium in the cell, the cover glass will now of itself go into position by the force of capillary attraction, and all that is necessary further is to squeeze out superfluous medium by gently pressing the top; clean it away, apply the varnish, then the cap, and after further varnishing and drying, the mount is complete. It is only necessary to add that in all microscopic work cleanliness and neatness are great desiderata.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

123.—GRIFFIN'S "IDEAL" COMBINATION PAPER KNIFE, ERASER, AND ENVELOPE OPENER.

MR. GRIFFIN, 5, Wisteria Terrace, Chapel Road, Stamford Hill, London, N., has sent me a very nice-looking and useful article which takes the form of a penknife, but whose handle is so cleverly contrived and fashioned that it will act also as a paper knife and an envelope opener. It is known as Griffin's "Ideal" Combination Paper Knife, Eraser, and Envelope Opener, and is sold at 2s. Its shape and make may be gathered from the illustrations given, Fig. 1 showing a back view and Fig. 2 a side view of the knife. Its length from end to end is 4 in., and its greatest width $\frac{5}{8}$ in. The handle is made of a solid piece of ivory wedge-shaped in form, being sawn through from the top, which is rather more than $\frac{5}{16}$ in. thick, for $2\frac{3}{8}$ in. of its length to admit of the introduction of the blade and spring. The length of the handle admits of its being shaped at the thin end, as shown in Fig. 2, the form thus given to it being convenient for opening the envelopes of letters by inserting the point under the fold on one side, and pushing it along the top, which is

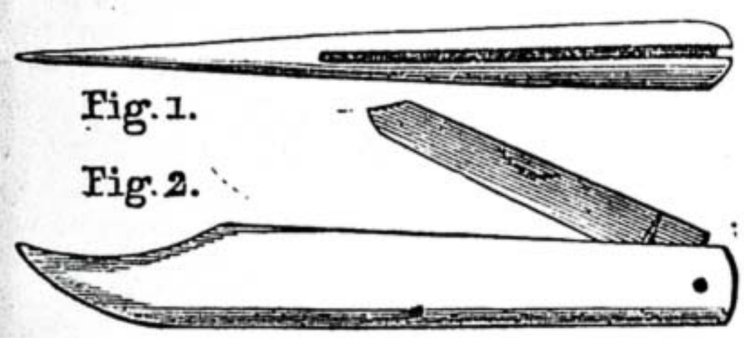


Fig. 1.—"Ideal" Paper Knife: Back View.
Fig. 2.—Side View.

ripped open by the pressure of the wedge-shaped point. The blade is wide and stiff, and of a shape well adapted for erasing or scratching out. The handle of the knife is marked with a trade mark of peculiar form, consisting of a diamond surrounding a square on which is marked the word "Ideal," a black diamond being placed in each corner of the square, two sides of each of the small diamonds being coincident to a certain extent with the sides of the large diamond, the ground of which is white. This trade mark is the distinguishing feature of Mr. Griffin's inventions, all of which are therefore known as "Ideal" articles. Among them I may be permitted to mention the "Ideal" Patent Adjustable Perpetual Calendar, the "Ideal" Date Table, now preparing for publication, the "Ideal" Revolving Box Cover, and the "Ideal" Parallel Ruler. I have an early copy of the "Ideal" Date Table before me, a table showing the day of the week on which each month commences, and also giving a complete calendar for any month from A.D. 1797 to 1955. THE EDITOR.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

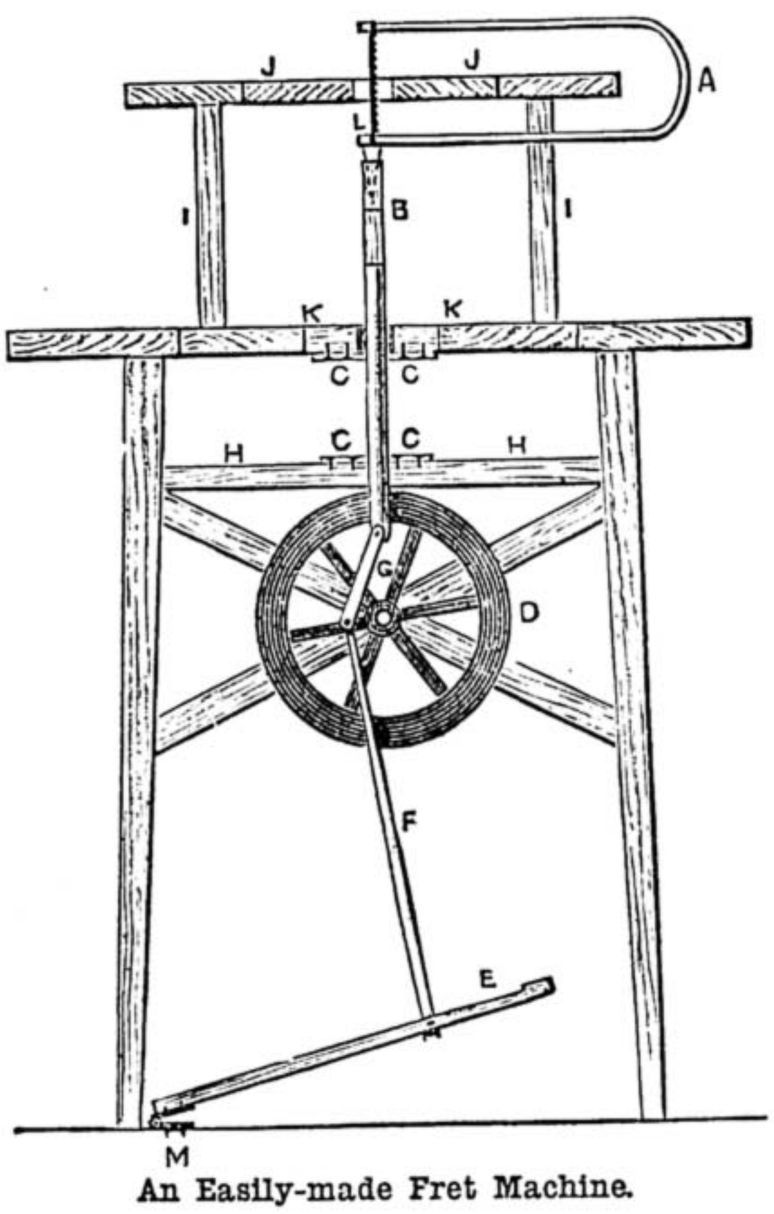
NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

An Easily-made Fret Machine. — F. D. (*Luton*) writes:—"In No. 21 of WORK, on page 332, I noticed an easily-made fret machine (?), which claimed certain recommendations to the amateur—namely, a vertical stroke, easily constructed, and could be made for a few shillings. According to the design, they were all false claims, at least, in my opinion, and I should guess that from the letters which have recently appeared in 'Shop,' asking an explanation, I am not the only one of that mind. However that may be, I am glad it appeared, as I had long wanted a fret machine, and it



An Easily-made Fret Machine.

gave me an idea which I now propose to give in my turn to the readers of your paper. My easily-made fret machine has, I believe, a just claim to the above recommendations, as the illustration will show. First a table or bench is made, and it will be best to make it of such dimensions that it will be at once a bench and saw combined. The sawing apparatus will of course be at the end of the bench. The cross pieces which support the wheel will next be fixed, and then the shelf, H, which if run the entire length of the bench will serve as a shelf and bearing for the rod, B, at the same time. The shelf, H, and top of the bench, K, have each an iron plate fixed to them with a hole bored to let the rod, B, work in. The table, J, is next made, and fixed by means of four pieces of wood about 2 inches square to the top of the bench, so that it is quite firm. It has a hole about an inch in diameter bored in it to allow the saw to work in. The wheel is then fixed in such a way that it can revolve freely without rocking. Next the crank, F, is fixed. Suppose the saw is 5 in. long, and the thickness of the table, J, $\frac{3}{4}$ in., the screw of the top of the crank, F, must be 2 in. from the centre of the wheel. That will give 4 in. throw, and if the table, J, is $\frac{3}{4}$ in. thick, a quarter of an inch will be allowed between the top of the table and the under side of the top part of the saw frame. The crank, F, is not fixed direct to the rod, B, but is connected with it by a smaller crank, G. This apparatus gives a perfectly vertical stroke, and I believe is altogether what I claim for it—namely, a good machine at a moderate price. The rod, B, is a brass tube, and is flattened, drilled, and tapped to receive the screw which connects the crank, G, to it. The upper end is filled with a piece of wood to hold the end of the saw frame."

Cheap Hearth for Smithing.—WORKER BEE (*Hertford*) writes:—"I would like to say a word of congratulation to A. H. (*Wolverhampton*) for the excellent hearth he has given us on page 556, and to point out to him, as well as A. S. (*Liverpool*), that his blast will be far more effective if the pipe marked 'A, Fig. 7,' is made slightly tapering all the way from the mouth of the fan to the nozzle of the tue-iron. I knew a chap who rigged up a nice little forge, but could not get it to go until he had made this alteration."

Band Saws Breaking.—WORKER BEE (*Hertford*) writes:—"A. R.'s (*Scorrier Saw Mills*) remarks always attract my attention, because he not only knows what he writes about, but also, like myself, is a 'Cousin Jacker.' All the reasons he gives for band saws breaking are good and, I fear, too true, but in my experience the most fruitful cause of breakages is when the wood from various causes (such as the plank being warped or hollow, as it frequently is) does not lay 'dead' on the table at the exact spot where the saw passes through it. The plank vibrates or 'chatters,' as we term it in the mill, more or less, and the probability is the saw snaps before it has cut sufficiently far to allow the plank to lay flat on the table again. I was about to say a few words on polishing cutlery, and one or two other matters, but must refrain, or I shall be dubbed a *multum-in-parvo* critic."

Model Yachts, etc.—NAUTICAL (*Waterford*) writes:—"As OXYGEN surmises, articles in designing and building model yachts that will sail well will interest others besides him, and will, I think, extend the circulation among the younger members of the fraternity. Model yachting is not such child's play as it may seem, and is a healthy as well as pleasant pastime—a consideration to some who are engaged in workshops, etc., during a long day. I hope to see designs and hints for building or making a good racing model soon, and wish you every success with your magazine."

Cabinet for Fretwork.—F. P. (*Bath*) writes:—"I was forcibly struck with the beauty of Mr. Gleeson-White's design for a cabinet in fretwork in your first issue of WORK, and determined, sooner or later, to attempt its construction, but as no hint was given as to the thickness of the wood to be used for the purpose, I decided to wait awhile, hoping that some brother amateur would lay before you the result of his labour so that I might glean some information for my guidance. In a subsequent number (6) T. F. seems to have undertaken it, but failed to produce the desired effect, owing to his having employed too thick a wood. Having some very old dark oak panelling by me, I had them planed down to $\frac{1}{8}$ of an inch thick, and then commenced cutting out the pattern carefully traced from Mr. Gleeson-White's design. On the completion of the pieces for two cupboard and four drawer fronts, I procured some mahogany $\frac{3}{8}$ in. thick for backing, and, adopting Mr. White's suggestion, gave each piece of mahogany three coats of white enamel paint, laying my work on the last coat whilst wet, and then subjected the several pieces to pressure until the paint was dry and hard. This was continued for three days, and on removal from the press the fretwork was found to be firmly embedded in the paint, and in a solid condition for cleaning up and polishing. I should have acted wisely had I followed your advice and have used thinner wood (say $\frac{1}{16}$), but notwithstanding my self-will, the cabinet is much admired as a fair substitute for marquetry. I must add that the body of the cabinet was constructed of mahogany, ebonised, by a skilled cabinet maker, and now forms a goodly ornament in my wife's drawing-room. Thanks to WORK."

Fret Saw.—A. J. A. (*Malvern*) writes:—"I notice that A. A. (*Coventry*) (see page 636) whilst finding fault with methods of fitting up saws for fret cutting contributed by ARTIST IN WOOD and W. R. S., has in his own sketch for fret saw totally omitted to give any idea as to how he obtains the necessary motion without a fly wheel. I presume this was an oversight."

Tuition in Carpentry.—R. A. P. (*South Kensington*) writes recommending in strong terms the classes held by Mr. S. Robertson, 11, Augustus Road, Goldhawk Road, Shepherd's Bush, London, W.

American Organ and Harmonium Building, Book on.—J. B. (*Ashton-under-Lyne*) writes:—"In Vol. I, page 673, G. N. says he does not know of any book on the above subject. May I inform G. N. and the readers of WORK that much information may be gathered from two books published by Metzler & Co., 42, Great Marlborough Street, London, W.—"The Alexandre Harmonium: Its Mechanism, Stops, Tuning, Regulating, etc.," clearly explained, with drawings and plates of various instruments; and "The American Organ: Directions for Tuning and Regulating Mason's and Hamlin's Organs," preceded by a description of their mechanism, stops, etc.; also *Musical Times*, No. 421, Vol. 19. I, like many more of your readers, am waiting for the long-promised papers on American organ manufacture. Hoping your readers will help each other when opportunity presents itself is the wish of MUSICAL. Please say if back numbers can be had. I am about two numbers short since WORK started."—[Yes, all the back numbers are obtainable through your bookseller or Messrs. Cassell & Company, Limited, London, E.C.]

Cork Heels, etc.—T. R. (*Ripon*) writes:—"If H. G. (*Bishopsgate*) (see page 526) would tell me how many irons are used in finishing the

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shanks of boots and shoes, such as waist, fore part, etc., and whether the shank irons do for men's and women's alike, I should be obliged. The description of the "Wurtemburg" is what I wanted, but should like to know if the screw nails are driven in slant outwards or inwards, and how to make the breast level with the sole? Should there be a piece of leather under the heel of the insole or across the balls? This part in particular I hope will not be looked over. Please say also in a heel of a boot or shoe 2 in. high and 1¾ in. broad at top piece how may split and lifts be sloped in; if the pegs or rivets should be slanted in the same way—the split lift from the edge of seat for men's light boots or shoes handsewn on wooden lasts; how to dress a pair of welts, and how to make a close-welted boot, and broad, and medium?"

Band Saws.—A. R. (*Scorrier*) writes:—"In my remarks on band saw machines and band saws in No. 35 of WORK (see page 556) I said the top wheel should rise and fall freely. This will allow for the expansion and contraction of saw. I might add that I have worked saws ⅜ in., ¾ in., and 1 in. wide with 5 and even 6 brazes in them, and they seldom break in the braze, and with as many as 4 and 5 flaws half-way across the saw by punching a small hole at the end of flaw. I was rather amused with some remarks on band saw brazing on page 621. I never heard of a stone or brick wall being used for brazing band saws on before. I should judge it to be a very clumsy way to braze a band saw. It may be all right."

Clocks in Fretwork Cases.—A. B. C. (*Christchurch*) writes:—"On page 606, column 1, line 11, word 'left' should be 'right.'"

A Word in Season.—J. W. H. (*London, S.E.*) writes to querists in "Shop":—"(1) Do not ask us for information, vaguely expecting to be taught a trade or process by a few magic lines. It stands to reason that the short allowance of space at our disposal cannot be made a finger-post to any royal road to learning. (2) Don't be discouraged by failure in attempting anything well begun! Give us the fullest detailed account you can of any difficulties you may encounter; give us a fair chance of coming to a logical conclusion as to the causes of failure by stating your case fully, and you will have no cause of complaint in our answers, but if you only tell us half the circumstances, how can you expect to be more than half counselled? (3) Write at full length; we must be brief in reply. (4) If you ask more than one question at a time, pray use a separate piece of paper for each query."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Staining Floor.—DECORATOR.—The floor of the room you refer to having been painted, you cannot treat it as if the boards were still in the natural state. Your questions are rather involved, but as far as I understand you want to know how to polish the existing painted surface, or how you can get the paint off in order that you may stain, and the answer to your letter is given accordingly. It certainly would be hardly worth while for you to take the trouble of "polishing," if by this is meant French polishing the floor. A sufficient brilliancy may be got with far less trouble and expense by varnishing it in the usual way, which, as a decorator, you are, no doubt, practically acquainted with. Of course, if the paint is much disfigured by wear there is no reason why you should not repaint, in which case there is no necessity for removing the present coat. This, I think, would be a far better way than staining, for before this can be done you must remove the paint, which you will probably find a very tedious and troublesome operation. It seems almost unnecessary to remind a decorator that the paint may either be burnt or washed off with one or other of the many well-known preparations, and that the paint on the skirting board is very apt to be injured. Without knowing all the circumstances of the case, I am inclined to think that if the floor is to be stained it will be advisable to have it planed over. So much, however, depends on its condition that I cannot do better than advise you to use your own judgment, for you will readily see that an amount of trouble, which might well be bestowed on a fine oak or pitch pine floor, would be thrown away on one of the ordinary kind. Finally, neither I nor any one else can tell you how to "stain with the paint on," as it can't be done.—D. A.

Dry Battery for Electric Lights.—ASCA (*Newcastle-on-Tyne*).—I do not know of any dry battery giving an E.M.F. of 4 volts from two cells in series. The silver chloride battery has an E.M.F. of 1·02 volts per cell, or each pair of elements, so that you would require four cells and four pairs of elements to give you the needed E.M.F. from this battery. This is the nearest I know of likely to suit you, as it is quite free from liquid, and very light and compact if made up with ebonite cells. The elements of the battery are:—Negative, a silver plate coated with silver chloride paste kept in position by blotting-paper pad; positive, a zinc plate enveloped in blotting paper, moistened with a solution of zinc chloride. The zinc plates may be 4 in. by 2 in. by ⅛ in., and the silver plates may be of silver foil, having the same surface area. Connect three of the pairs together by soldering strips of copper to their tops; this will leave one zinc plate to form one pole of the battery, and one silver plate to form the other pole. The cells should only be large enough to admit the plates with their folds of blotting paper, so that the intervening paper may be pressed between the zinc and silver plates in each cell.—G. E. B.

Coppering Blackleaded Moulds.—COPPERED PLUMBAGO (*Malton*).—Knight's process of coppering blackleaded moulds previous to placing them in the electrotype solution is as follows:—First, blacklead the mould in the usual way. Then wash off superfluous plumbago with a jet of water. Next flood the face of the mould with a concentrated solution of sulphate of copper. Over this sift some very fine iron filings through a very fine sieve, or dust the mould with finely-sifted iron filings from a kind of pepper-box. Brush the face of the mould with a soft brush, and wash off excess copper and iron with a rose jet. By this means finely-divided copper is precipitated by chemical action on the blackleaded surface of the mould, with the result that a superior conducting surface is presented to the electrotyping solution. I do not know where you are likely to get the "impalbably fine iron filings" ready to use. They are easily got by sifting ordinary iron filings through a very fine sieve, or rubbing them through a fine wire mesh.—G. E. B.

Fret Machine.—C. J. D. (*Glasgow*).—You say that you made a model of this, but could not get the pipe to move up or down. I think that the fault is that you have not got the pipe exactly over the centre of the wheel (if you turn to page 332 you will see that I specially mentioned this), or else the bearings are not bored straight. You must please remember that the wheel runs on an ordinary axle, as in Fig. 1, and that the bottom part only of C is

Fig. 1.

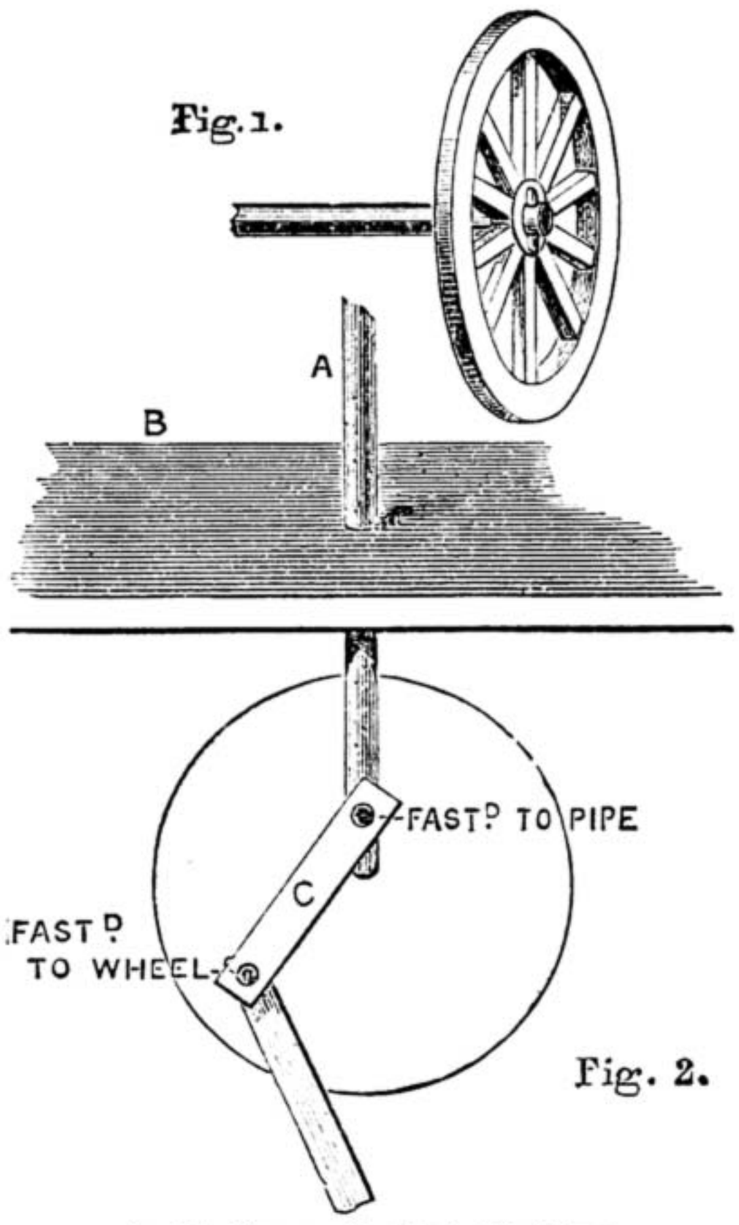

Fig. 2.

An Easily-made Fret Machine.

fastened to the wheel, and the top part to the pipe, as in Fig. 2. You also say that you wish me to give you a correct drawing of the machine. The illustration on page 332 is perfectly correct, and is the same as the machine I have here, which I shall be pleased to show you if at any time you are in London. I might add that your letter is not a very complimentary one, as it seems that because you are not able to make the machine you think that the best thing to do is to abuse it.—W. R. S.

Replating Brass Caps.—R. C. (*Wood Green*).—Strip all the old silver from the brass caps by boiling them in sulphuric acid, and adding, whilst the acid is hot, a few crystals of saltpetre. The acid should be heated in a porcelain crucible, or glazed earthenware pipkin. Add the saltpetre until all the silver has dissolved off, then take the caps out of the acid with a pair of brass or copper tongs, and throw them into clean water. After this, brush off all loose silver with a wire brush, scour the caps with bath brick in water, well wash them, and quick them in a nitrate of mercury solution ready for silver-plating in the bath. I must ask you to be good enough to look up other replies to correspondents relating to electro-plating for further information respecting how to make up and work the silver-plating solution. I hope to take up the subjects soon in a series of articles, and then you will be able to learn all about it. Dynamos, motors, and other "electrical hobbies" will receive attention in due course, and you will then, I hope, be abundantly satisfied.—G. E. B.

Oxford Picture.—F. M.—In answer to yours, a small circular saw is used for cutting rebate in Oxford frames, fixed in bench sufficient to cut depth in wood desired. A cutting gauge is used sometimes, but is very hard work. Spokeshave is used for chamfers and chisel. You can buy the wood ready rebated, and can neatly fill the ends in. If carefully done, it is as good as cutting out of solid. Almost any moulding can be treated in this way, black and gold, etc.—G. R.

Charging Batteries for Electric Lighting.—J. T. (*Walham Green*).—Charge your battery with a solution of chromic acid, made by dissolving 3 oz. of chromic acid in 1 pint of water, acidulated with 3 oz. of sulphuric acid. With this solution your three-celled battery will give a current of 1½ ampères at a pressure of 6 volts for some four or five hours with one charge of solution. If you select a 6 volt 2½ c.p. lamp, this current will light it up nicely during that time.—G. E. B.

Leaf and Flower Printing.—LEAFLET.—Impression of leaves, etc., can be taken on wax or cast in plaster of Paris, but the process is too long to describe here. I shall, however, be happy to contribute an article on the subject if of sufficient interest, as this was a favourite hobby of mine in my younger days. LEAFLET may also try the blue printing process recently described in WORK, as it is often used for the purpose of copying leaves and plants.—H. L. B.

Mounts and Cardboard for Ticket Writers.—TICKET.—Write to Messrs. Surflen & Clarke, 3, Bucknall Street, New Oxford Street, W.C., and ask for their price list, which will be sent post free.—H. L. B.

Transfer to Metal Plate, etc.—F. J. L. (*Bristol*).—I know nothing about the process of the first query. The only ink that can be used on zinc to withstand the action of acid is of a greasy nature, such as that used by lithographers, which can be ground up thinly and used with a pen on stone, transfer paper, etc. The drawing would have to be transferred to the zinc from the transfer paper, unless drawn on the metal with a fine brush. The pen would scratch the zinc. See a manual on lithography.—F. M.

Clock Cleaners.—W. E. S. (*London, E.C.*).—Take off cylinder cock, and with a pinion gauge measure from jewel hole to middle of curb pins. Select a hairspring the same size, take hold of outer end of the spring, pass the cylinder bottom end up through the centre of it, and let it hang by the notch. Then measure as near as you can the distance the cylinder and balance draws the spring down. If about a length and a half of the cylinder it may possibly do (if you have the old spring you can get near the right strength by comparing the old and new). Now take the collet off the cylinder, and take the pin out that fixes the inner end of spring to collet. See if the collet will go inside with a little room to spare. If not, break out coil till it will go, then bend a small portion of the inner coil straight so that it will make a half-circle. Then pass the straight piece in the hole of collet and pin it in tight. See that the spring and collet are quite flat, replace the collet on balance or cylinder, lay the cock on the bench on its back, put cylinder cock pivot in the hole, pass the outer end of spring through the stud in the cock, and pin it in. See that the spring is free everywhere, and that the watch is in beat, set going, and note time. If it gains, you must go all over the work and put a weaker spring; if it loses, try breaking off a turn or half-turn first of the outer end; re-pin and try, but if after taking off one or at most two turns and it still loses time, why you must put a stronger spring, but unless you have a good selection of good springs, I should advise you to send or take to any watch tool shop, the cost of springing and timing being only about two shillings.—A. B. C.

Book on Heating.—MECHANIC (*Lewisham*).—Hood's "Warming and Ventilating," Spon & Co., 12s. 6d., is a good book.—F. J. C.

Book on Cooper's Work.—Δημᾶς.—A suitable work is "The Cooper," price 1s., in Houlston's Industrial Library.—F. J. C.

Moulding Indiarubber.—C. P. C. (*New Kent Road*).—This substance, which is the dried sap of the *Hevea Guianensis*, etc., cannot be moulded whilst in the pure state, although the sap as it runs from the tree may be used to coat the external surface of any article selected as a mould, which, indeed, is the method adopted in the collection of the gum in its crude commercial form of "bottle rubber," but such a process is evidently of extremely limited application, and has no commercial value. Moulded articles of so-called indiarubber are formed of an intimate admixture of indiarubber and sulphur with various adulterants, the mixture being pressed into hollow moulds of suitable shape, and simultaneously subjected to a temperature varying according to the amount of sulphur contained in the raw mixture, and the degree of hardness required in the finished article. The heat not only softens the compound, and so enables it to conform to the exact outline of the mould, but also effects the vulcanisation of the rubber by chemically uniting the sulphur therewith, the result being a more or less elastic object capable of retaining permanently the form of the mould in which it was vulcanised. The pressure is needed to counteract the expansion which would otherwise be caused by the liberation of sulphurous gas, the result of such expansion being rubber of a spongy texture similar to that sometimes used for cleaning gloves. The adulterant is added to give "body" to the mass, and to reduce cost at the same time. It may consist of any inert substance capable of resisting the heat employed in the vulcanising process. Unvulcanised sheet rubber of various qualities and thickness may be obtained

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at almost any shop for the sale of rubber goods.—QUI VIVE.

Cracks in Oven.—J. D. (*Hanley*).—Try one of the following cements. You will find them all good for the purpose you require:—(1) Flour of sulphur ½ oz., sal-ammoniac ½ oz., finely sifted iron borings 20 oz. Mix to a stiff paste, and apply immediately to the crack. (2) Five parts of fire-clay well dried and powdered, 3 parts of fine iron borings or filings, 1 part peroxide of manganese, ½ part of salt, and ½ part of borax. Mix these thoroughly, and make a paste with the necessary water, mixing well. The parts cemented with this mixture should be heated gradually. This will stand a red heat. (3) Dried and powdered fire-clay ½ lb., iron filings ½ lb. Make into a paste with boiled linseed oil. If you could get to drill a hole or two in your oven, and put on a plate with a few small fender bolts, with some portion of one of the above named cements, that would make the best job of it.—R. A.

Rifle.—DERRY.—I am inclined to think it is not so much because your rifle is not often used as because it is badly and carelessly kept when not in use that it "gets a sort of rusty, etc." Keep it clean, well oiled, and in a dry place, and you will not find it rust either inside or outside. There is no way by which you could "blue" the barrel satisfactorily without risk of injuring it, unless you are accustomed to the work. It is done by heat. I quite agree with you that WORK is a splendid paper for instruction, and I am only sorry that I cannot answer your question more definitely. Thank you for your good wishes.—D. A.

Upholstery.—S. M. (*Battersea*).—Your hope will not be misplaced, as we shall not print your letter, which has been written under an imperfect appreciation of facts, and reminds one of the old tale of the peaceably inclined Hibernian who trailed his coat on the ground for some one to tread on. Your perception of the contents of a former correspondent's letter is wonderful, the only point on which you are wrong being that he did not ask for information on the subject to which you allude, and, of course, this slight error disposes of the utility of the major portion of your remarks. We do not see how you can have taken up the idea that we think drapery cutting is woman's work, for the sentence on which you found your assumption begins thus:—"With the exception of planning, etc., draperies, the actual making up is done mostly by women." As one who is very much in the upholstery trade, I cannot find in this anything to indicate that women are engaged in cutting. An upholsterer was replied to, and knowing his question he would understand the answer. You, not knowing his question, have misinterpreted the answer. Of course I am glad to have your opinion as to what would be useful to readers, but I am not convinced that the cutting of draperies would be a subject of sufficient interest to warrant much space being devoted to it. Here and there a reader might find a benefit, and you may be sure the matter will receive all the attention it deserves, if there should be anything like a general wish for papers on upholstery drapery. Perhaps those who agree with you that these should be given will write saying so, for the desire of all concerned is to make WORK as generally useful as possible to all classes and crafts. It is news to me that cutting is not taught in trade except for an extra premium and in exceptional cases. Of course you know that in many shops, especially in London, drapery is not attempted, and that the men are only stuffers, a word which you have possibly heard rhymes with "duffers." You will usually find that cutting draperies is not specially taught, but is acquired, if I may express it so, gradually. The foreman takes an interest in the smartest boys who show some aptitude, and they by degrees become conversant with the "fine art" of the upholsterer's work. There are several old books dealing with draperies, but I do not think you would find any of them of much use. If you are inclined to study them you will find many in the South Kensington Library. It is very likely that before long an article on drapery, with an illustration, will be given in WORK, whose pages, I quite agree with you, will not be degraded by it. Your remark that "one good design," accompanied by full directions how to cut out same, "would be sufficient for all purposes," simply amazes me. How can directions for festooning a chair, for example, teach you or any one else how to drape a window or a bedhead? No, my friend, you will find that each article, each design, must be specially studied with due regard to material, quantity, colour, cost, etc., and that it is absolutely impossible to formulate a few rules which shall be applicable and sufficient under all circumstances. A namesake of yours was at one time, perhaps is still, foreman in one of the largest upholstery shops in London. Ask him, or any other upholsterer, if he can kindly tell you of any one design and instructions which will enable any one to master the art of cutting and arranging draperies, for if you can get to know, and will send us word, you will confer a benefit on all young upholsterers, for whose benefit the directions—with your permission—will be printed in full.—D. A.

Etching with Nitric Acid.—SPOT (*Lancashire*).—In answer to SPOT, the first thing you should do is to see that your metal is quite clean, then heat it sufficiently to melt a composition of asphaltum and Burgundy pitch, called etching ground; or of asphaltum, gum mastic, and resin. This should be placed on very thinly, and allowed to cool, when it will be found to be of a hard consistence, and ready to receive the subject to be etched, which is drawn on transparent paper with a blacklead pencil, and then laid face downwards on the etching ground, and pressed or rubbed with such force that the impression is left on the ground when the paper is removed. Next apply your tool over the lines, carefully removing the ground, at the same time pressing sufficiently hard to scratch the surface of the metal. A wall of wax is now placed round the margin of the plate, and some aquafortis poured in the inclosure. Let this stand for about an hour while it bites in, then wash the plate with water, and let dry.—S.

Counter Case.—W. P. (*Liverpool*).—As an amateur you will not find the construction of a show or counter case an easy matter, and all that can be done is to indicate the course you should pursue, or, rather, the course I should advise you to take, for possibly an expert show-case maker, especially if lightness of appearance were a *sine quâ non*, would go about the work in a somewhat different manner. I think you will succeed better by not making the framework too light, and I suppose you want something serviceable. I fancy you are under the impression that the wooden framing, or what you call the beading, is added to the glass. If so, let me put you right. The skeleton case, or framework, is made up first, and the glass fitted into it. Regard the case as so many frames, which are to be glazed much the same as a window would be, and you will understand what is wanted. Now, to give you a few hints about making the case. The bottom board you will not need to be told about, but you may as well get it out first, as it

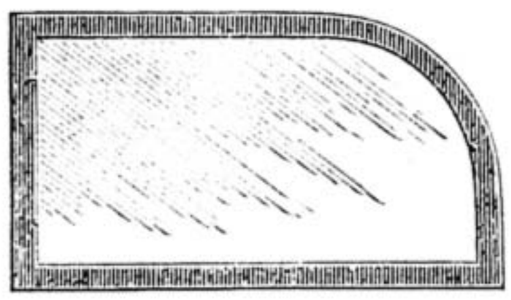

Fig. 1.

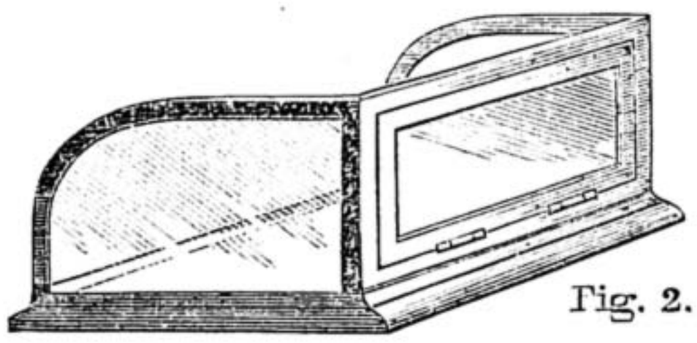

Fig. 2.

A Counter Case.

will guide you when making the rest. For the framing into which the glass is to be fitted, use ¾-in. square stuff. Make two frames for the ends as Fig. 1, and a similar one, only rectangular, for the back. Within this latter, fit another to serve for the door. Hinge this to the lower portion of the back frame. Fasten the back frame and ends together with glue, if necessary running a bead to break the joint, and using a few screws. Fasten the entire framing to the bottom board by the same means, the screws being driven through from below. The framing must be rabbeted to receive the glass, which can be kept in place either with putty or small beading. Along the front fasten a rabbeted piece for the bottom of the glass to rest on. See that you get the glass bent, so that it lies within the rabbet without straining; in other words, it must be a perfect fit or it is sure to break, and I daresay you know that a bent piece of glass is somewhat expensive. Anything you have not understood of the construction I suggest, will, I think, be sufficiently intelligible from Fig. 2.—D. A.

Boring Holes in Glass.—H. M. (*Slevoye*).—Holes may be bored in glass with a steel drill lubricated with turpentine and camphor. I certainly should not advise you to attempt to mend your own spectacles, for you will probably break the glass.—D. D.

Small Portable Electric Lamp.—AMMETER (*Woking*).—A small lamp to go in a kind of lantern surmounting a small box battery would just suit your purpose. I do not know the "Miner's Lamp made by the Mining and General Electric Lamp Company, Limited, Crown Works, Guildford Street, Lambeth," but shall be glad to see one, and will report upon it for the benefit of readers if the company will send a sample to me to be tested. Until I have seen it I cannot recommend it to you. In answer to your second query, I may say that Mr. S. R. Bottone, Carshalton, will make you a small box battery (of the kind supplied to myself), and this, together with lamp and fittings, will cost about £1. The salt to charge it with can be supplied by the same gentleman, and the charge will cost about 1s. 6d. This will give a 5 c.p. light for three consecutive hours, or the light can be used at intervals as you suggest, as the battery is easily thrown in and out of action by a simple mechanical device. I shall hope to illustrate and describe this battery in my articles on "Model Electric Lights."—G. E. B.

Recharging Leclanché Battery.—G. H. W. (*Barnsley*).—You are right in thinking that a piece of gas retort scurf, sawn to the shape of a carbon plate, will do to form the negative element in a Leclanché cell. But I think you have gone wrong from this point. This carbon plate must not be packed in the porous cell with the little bits of carbon sawn off from the plate. This is not the stuff it was charged with, however much it may appear like it. The cell was charged with lumps of manganese peroxide mixed with little bits of carbon in equal quantity, and you must pack the carbon plate in the porous cell with this mixture, or your battery will not work. The manganese looks very much like carbon to the unpractised eye, hence you and your friend were deceived by appearances. Again, it will be useless to recharge the old porous cell, for its pores are, most likely, clogged with zinc salts. You must get a new porous cell. The old carbon plate might be used again. Read what I have said about the Leclanché battery on page 419, No. 27, Vol. I. of WORK, and this will help you.—G. E. B.

Fountain.—H. G. H. (*Lower Tooting*).—A paper on this subject was given in No. 31.

Wrought Iron Columns.—A CONSTANT READER (*Wolverhampton*).—For angle, tee, and channel iron columns, and for columns built up of these sections by themselves or in connection with plates, you may use the following rule:—Divide the square of the length by the square of the least width; divide the quotient by 900. Add the fraction so found to 1, and by the sum divide 19; the result will be the breaking weight per square inch of horizontal sectional area. Example—Require the strength of a tee iron strut, 5 feet long, 6 inches wide, and 4 inches deep; the least width is the 4 inches, $4^2=16$, 5 feet = 60, and $60^2=3{,}600$, $3{,}600\div16=225$, $225\div900=\frac{1}{4}$, $19\div1\frac{1}{4}=15\frac{1}{5}$ tons per sectional square inches. The sectional area of the tee iron, if ½ in. thick, will be $(6+3\frac{1}{2})\times\frac{1}{2}=4\frac{3}{4}$ square inches, and, therefore, its breaking strength $15\frac{1}{5}\times4\frac{3}{4}=72\frac{1}{10}$ tons. The strut should not be loaded with more than one-fourth or one-fifth the breaking weight. The same rule will apply to English rolled joists, but those of Belgian make are so unreliable we should not care to give a rule for them.—F. C.

Polishing Table Top.—NIL DESPERANDUM (*Tamworth*).—Perhaps it would be more correct to say that your table top shows the inequalities of surface than that it acquires an uneven surface while being "bodied up." Are you sure that you have made it quite level before beginning to polish? It must not be forgotten that inequalities which might be passed over while the wood is in the white may show up when it is polished. If this is not the cause of the defect you notice, it must be owing to the polish being unevenly applied. The result of this is that the shellac, or body of the polish, is thicker in some places than others. If this be so, you have probably used your rubber too wet. In any case whatever be the cause, you must clean all the polish off again. You can easily do so either with a scraper or glasspaper used in the ordinary way with a cork block. I do not think you need trouble your head about the stuff you saw used. From what you say I imagine it was pumice powder, which might do well enough in experienced hands, though I certainly should prefer glasspaper. I am afraid the polishers you saw troubled in the way you are could not have been very skilful, or they would not have worked up an uneven surface. Possibly they used the substance merely to dull down, but anyway you will find the remedy suggested is effectual.—D. A.

Electric Accumulator.—C. D. (*Hull*).—Long before this appears in print you will have read my reply to D. S. (*Holloway*) (see page 477) on this subject, and will therefore know how to prepare your accumulator plates. You have done quite right so far in cutting the plates to the proper size. As the 1 c.p. lamp may have a voltage of 3 or of 8, I cannot say how many cells you will need, but you will have enough in the 6 at your disposal. You may reckon on getting an E.M.F. of 2 volts from each pair of plates in each cell whatever their size. The larger cell will not in itself give sufficiently high E.M.F., however many plates you may have in it, as the whole plate surface would only represent one pair. You may employ the 2-quart Bunsen cells connected in series to charge the accumulators, one cell at a time. When the liquid in the accumulator cells gives off bubbles of gas and appears to boil, the charging is complete. Although I have thus replied to your questions respecting the accumulator you wish to make, I do not advise its use in lighting a buttonhole lamp. See reply to ASCA (*Newcastle*), page 748.—G. E. B.

Battery to Fire a Charge of Powder.—W. G. (*Weybridge*).—I cannot see how a charge of powder could be fired by current from such a small battery without using a coil. With a coil it could be easily made to fire an Abel or a Statham fuse. If you wish to fire the charge with the battery current only, make up four cells, charge them with a solution of chromic acid or bichromate of potash, connect the four cells in series, and use a fuse made in the following manner:—Twist the ends of two cotton-covered No. 18 or 20 copper wires together, separate the extreme ends and uncover them. Connect the two ends by a very short piece of extremely thin iron wire twisted around the copper and soldered thereto. Insert this into the powder in the tube of the fuse. The tube may be of anything capable of holding powder, such as a quill, a hollow elder, hemlock, parsley, or hogweed stem,

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or a bit of metal tube stoppered at both ends with a cork or a tube of paper. A tuft of gun cotton around the iron wire will increase the firing quality of the fuse. The battery must be made so that the zincs may be lifted out of the solution when not wanted, or they will be eaten away by the acid.—G. E. B.

Miniature Electric Lamp.—VENUS (*Norwich*).—Four Fuller cells, with an E.M.F. of 1·6 volts per cell, will, if arranged in series, furnish current enough to light up a 2½ c.p. 6 volt lamp for the short time needed to see the time by a watch in the early morning. Have the lamp suspended over and close to the watch-stand on a table by the side of the bed, rather than on the wall at the head of the bed. Connection may be made between battery and lamp through a flexible cord carrying two No. 18 wires, and the push may be attached to the lamp support if you have this heavy as it should be.—G. E. B.

Ornamental Rock Work.—G. G. (*Gateshead*).—I am pleased to learn that you find WORK interesting and helpful. With regard to the ornamentation of house front, you will see in a reply to ROCKERY in present number a plan which cannot fail to be successful. A friend of mine a few years ago had a blank wall in a conservatory which he desired (as you do) to make more pleasing to the eye. I suggested and had carried out the method suggested to ROCKERY, and the result was very much admired, and very easy of execution. You see you cannot go wrong. The very clumsiness of one who does the work really improves its rustic and rugged appearance. With regard to your centre beds, I would suggest the formation of raised beds formed by "rock-working," and border of galvanised iron netting, say, 6 in. deep, as described in No. 20, filling up with earth, and repeat in a lesser irregular circle, thus forming a terrace for the plants, and a bold piece for the centre, made hollow, so as to be used for growing. You might also at the bottom of your wall, say, 2 ft. from wall at its widest part, erect a wire border of about 20 in. high, as irregular and bold as you can, using very large pieces of coke for the purpose, leaving here and there crevices for plants. Fill up with mould, and you will have a substantial piece of work.—C. M. W.

Rockery.—(*Clapham Common*).—You can make use of your wall for growing ferns, etc., with excellent effect as follows:—Decide upon the number of pockets of various sizes you intend to have, and hang them to the wall in irregular positions on strong French nails, then at distances of about 6 in. over all the remaining surface of the wall insert some French nails (not less than 3 in. long) into the mortar of wall. Have ready some pieces of cemented coke, as described, and lay a piece on each nail, using a little cement on each. Now mix up a quantity of Portland cement and very coarse sand—about 4 parts sand to 1 of cement—with water sufficient to make it a creamy consistency; thoroughly wet the surface of the wall, and fill up by dashing on the cement, so as to cover every inch of the brickwork. Lay on a little thicker where the coke and pockets project, and see that these are well secured with cement. The result of the foregoing will be that your wall will present an irregular and, to my mind, a very pretty rustic appearance. With regard to the fountain, I cannot advise you without further particulars. Where and at what height is the water supply, height of wall, etc.? Let me know these, and I will do my best to help you.—C. M. W.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Boot Bottoms.—SILLAW (*Rochdale*) writes:—"Will any reader kindly say how to fasten boot bottoms on when making a new pair? This information will suit me any time this winter. I am a clerk, but can mend boots, bind papers, etc., through your good work, WORK."

Furniture Cream Bottles.—T. B. (*Rochdale*) asks for the name of a firm who will supply him with these.

Terra-Cotta Stove.—NAGA (*Margherita, Assam, India*) writes:—"Having the facility for burning one, could any reader let me have through 'Shop' a sketch with detailed instructions for making a terra-cotta stove for bungalow? Not to have any iron in construction."

Watertight Boots.—RUTHENPHARL (*Saltburn-by-the-Sea*) writes:—"Can any of your readers suggest any means by which ordinary boots can be made watertight?"

Gold to Gild and Bronze Iron.—J. G. G. (*Glasgow*) will be glad of any information as to where to buy and how to use this.

Re-waxing Meerschaum.—A. H. (*Sydenham*) writes:—"I shall be much obliged if any reader will inform me as to the best method for re-waxing a meerschaum pipe."

Mandoline.—J. N. (*Tooting*) writes:—"I want to know how the body of a mandoline is made. I should be grateful for any information on the subject."

Exhaust Fan or Ventilator.—D. B. S. (*Ferns*) writes:—"Would any reader be kind enough to describe a simple way of drawing off dust from a grinding shop, 50 ft. by 21 ft., with loft overhead 8 ft. high from ground. There are a number of grindstones and emery wheels at work, and the dust from them is very unwholesome."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Building Railway Carriages.—F. C. (*Leytonstone*) in reply to R. C. C. (*Plaistow*) writes:—"There is a book published by Spon called the 'Car Builder's Dictionary.' The price is 12s. 6d. It is an American work, and is a dictionary of the terms used by American and English railway carriage builders. It gives no information respecting the process of manufacture. The engravings in it are excellent, but are principally of American stock. I do not think there is another book published in England on the subject."

Banjo without Brackets.—D. K. (*Gateshead-on-Tyne*) writes:—"In No. 37 of WORK, page 589, ALPHA (*Birkenhead*) asks information about banjo without brackets. I take opportunity of sending a very rough sketch, which I hope you will be able to understand. It is composed of two wood rims with wood screws, cup head for screwdriver, and small washers under the heads

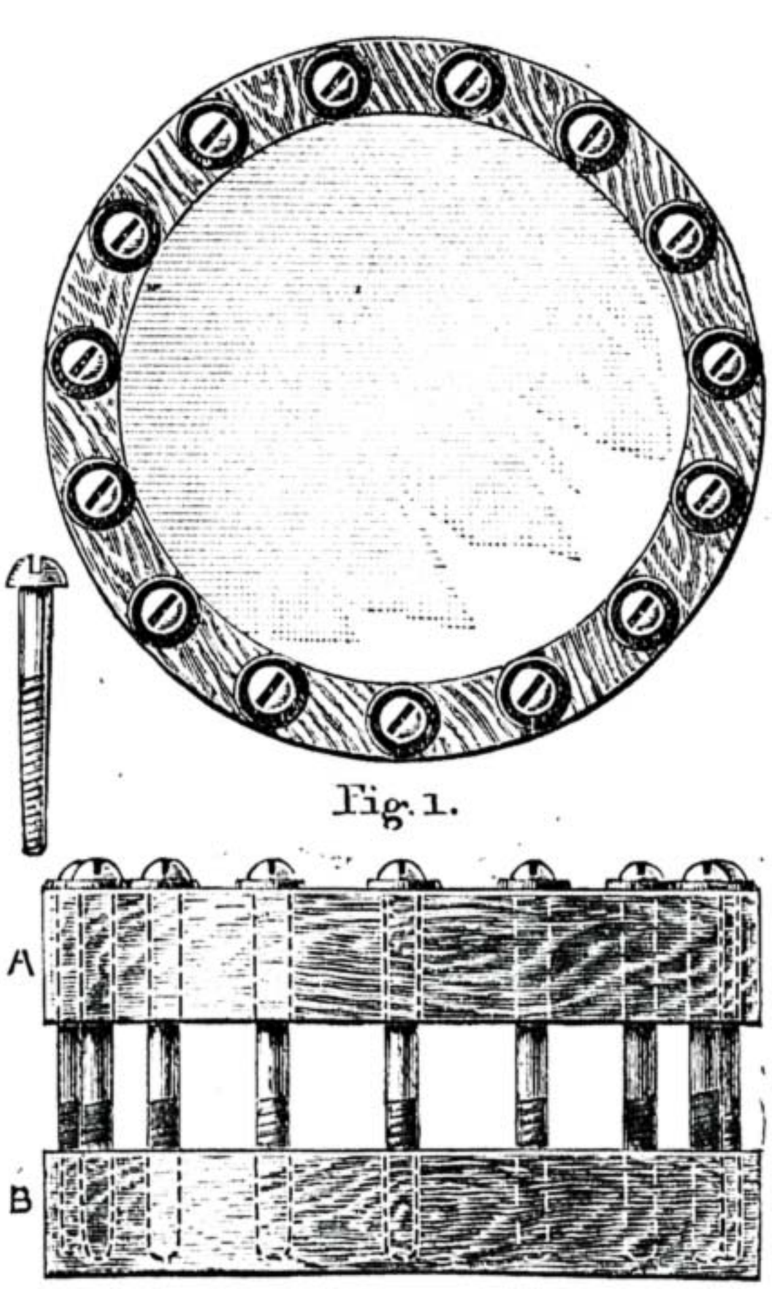

Fig. 1.

Fig. 2.

Banjo without Brackets.

of screws. Fig. 1 is the top rim over the top of the banjo skin showing the screw heads and washers. Fig 2 (A) is top rim showing screws, etc. Fig. 2 (B) is bottom rim into which the wood screws are screwed, and this rim is screwed on to the middle of the banjo drum from the inside, so that there are no screws seen outside. This is a very good and simple way, and I hope it will suit."

Pitch of Roofs.—W. D. (*Newcastle-on-Tyne*) writes in reply to C. M. (*Hornsey Park Road*) (see page 654):—"There is no definite rule for the pitch of roofs for greenhouse or shed, or in point of fact for any building at all, as a glance at the surrounding housetops will readily prove. However, a good roof for ordinary purposes would be to make the height one-third of the span."

Flux.—S. W. H. (*Aintree, near Liverpool*) writes to G. H. S. (see page 670):—"At a carriage factory in America with which I was connected they experienced a similar difficulty in finding a suitable flux for welding steel buggy axles. Ultimately marble dust (which may be obtained from any marble mason) was found more suitable than either borax or sand."

Dulcimer.—R. F. (*Norwich*) writes in reply to J. McF. (*Edinburgh*) (see page 636):—"I may say that I know of no reliable tutor for the dulcimer. There is one published by a London firm, but I hesitate to recommend it, as the scale shown is incorrect, being diatonic instead of chromatic—that is to say, there are no semitones corresponding to the black keys of the piano, so that it is impossible to play in more than one or two keys, and the tunes must be free from 'accidentals' sharp or flat, as no provision is made for them; and again, the method of beating there given is distinctly wrong. J. McF. will find a correct scale in No. 41 of WORK, page 645, and if he has access to a piano, and will tune his instrument to correspond with the notes, as shown in the diagram, he will find it fairly easy to master a few tunes in a short time. If he finds any further difficulty, I shall have pleasure in helping him in any way."

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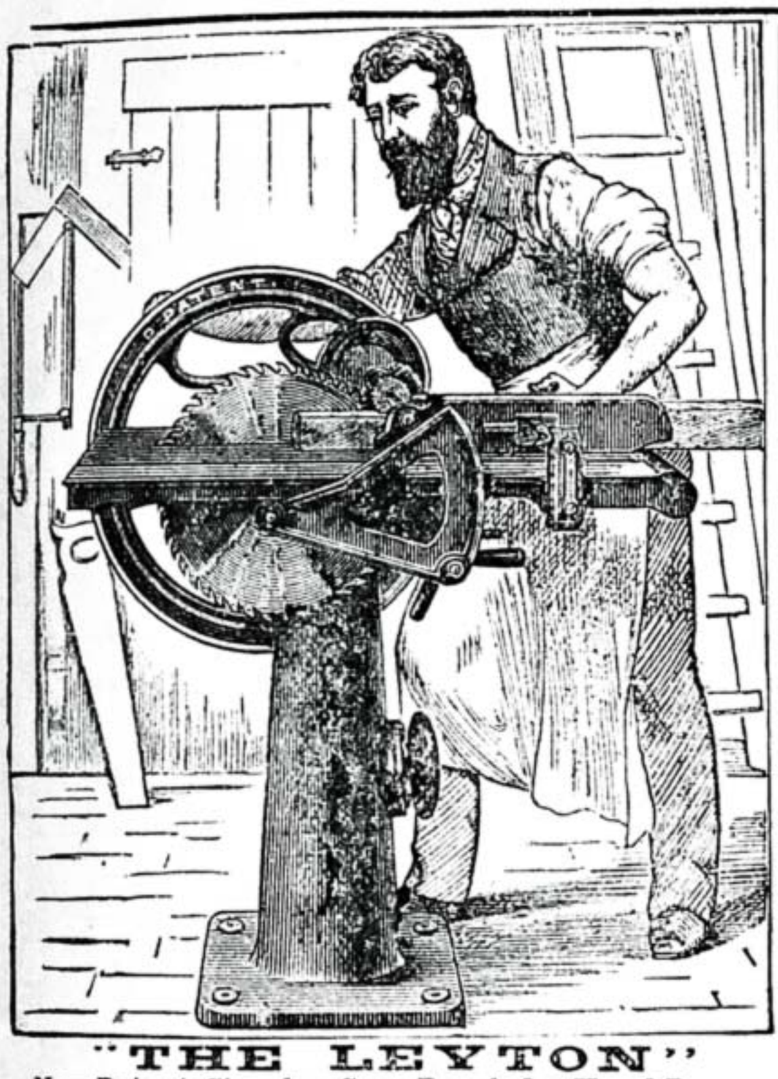

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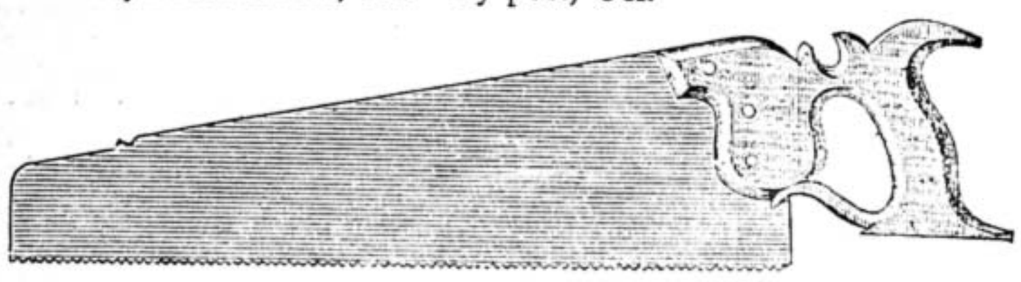

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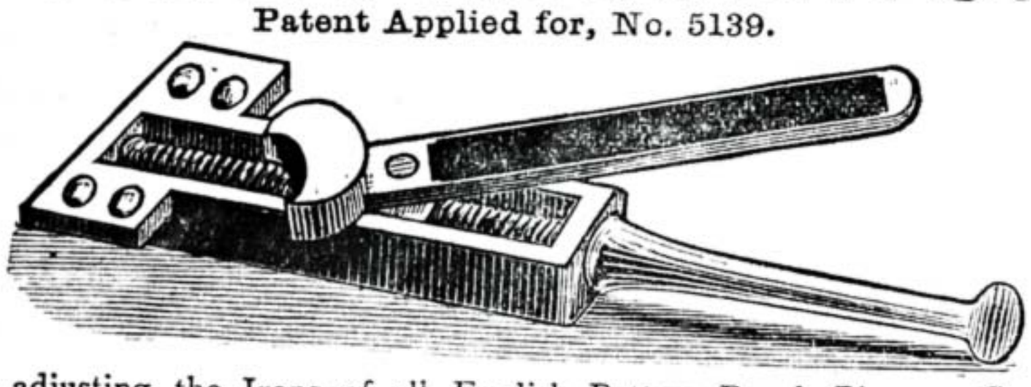

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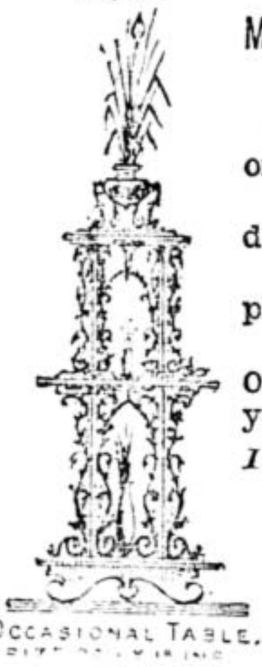

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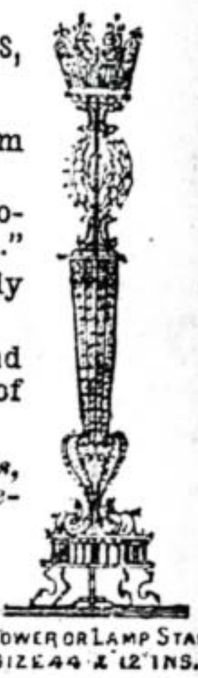

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